8425A
Digital Multimeter

Instruction Manual

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John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, Washington 98206

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Table of Contents

TITLE	PAGE
INTRODUCTION AND SPECIFICATIONS	**1**
Introduction	1
Description	1
Specifications	2
OPERATING INSTRUCTIONS	**6**
Introduction	6
Installation	6
Options and Accessories	6
Input Power Requirements	6
Measurement Instructions	9
External Reference (Ratio)	10
Remote Control Unit	10
Data Output Unit	11
Operating Notes	11
THEORY OF OPERATION	**13**
Introduction	13
MAINTENANCE	**14**
Introduction	14
Performance Test	16
Calibration Procedure	25
LIST OF REPLACEABLE PARTS	**32**

(continued page ii)

TABLE OF CONTENTS, *continued*

SCHEMATIC DIAGRAMS

Block Diagram 8425A-1500
Interconnect Diagram 8425A-1100
Wiring Diagram 8425A-1000
A1 Power Supply 8425A-1001
A2 Range Delay 8425A1006
A3 DC External Reference 8425A-1009
A4 AC External Reference 8425A-1008
A5 Remote Control Unit 8425A-1011
A6 Data Output Unit No. 2 . . . . . 8425A-1013
A7 Data Output Unit No. 1 . . . . . 8425A-1012
A8 Logic 8425A-1004
A9 A-to-D Converter 8425A-1003
A10 Active Filter 8425A-1015
A11 Buffer 8425A-1005
A12 Ohms Converter 8425A-1010
A13 AC Converter 8425A-1007
A14 Display . . . . . 8425A-1002 Sht. 1
A14 Display . . . . . 8425A-1002 Sht. 2

List of Illustrations

FIGURE	TITLE	PAGE
1	Model 8425A Outline Drawing	5
2	Control, Terminal, and Indicators	7
3	Code Conversion	13
4	Assembly Locations	15
5	Readout Check Equipment Connection	17
6	Equipment Connection for Ohms Test	19
7	Equipment Connection for DC Ratio Test	23
8	Equipment Connection for AC Ratio Test	24
9	Adjustment and Test Point Locations	25
10	Equipment Connection for Calibration	26
11	Equipment Connection for Ohms Calibration	30
12	Equipment Connection for DC Ratio Calibration	31
13	Digital Multimeter	34
14	Power Supply PCB	44
15	Range Delay	46
16	DC External Reference Assembly	48
17	AC External Reference Assembly	50
18	Remote Control Unit Assembly	54
19	Data Output Unit No. 2	58

(continued page iv)

LIST OF ILLUSTRATIONS, *continued*

FIGURE	TITLE	PAGE
20	Data Output Unit No. 1	62
21	Logic Assembly	66
22	A-to-D Converter Assembly	70
23	Active Filter	74
24	Buffer Amp Assembly	77
25	Ohms Converter Assembly	78
26	AC Converter Assembly	82
27	Display and Interconnect PCB	86-88
28	Data Output Unit Power	91

MODEL 8425A
SUPPLEMENT
INTRODUCTION AND SPECIFICATION

This supplement modifies the Model 8400A instruction manual to cover operation and servicing of the Model 8425A. The information is arranged in the same order as the instruction manual. If no reference is made to a particular paragraph, that information is considered applicable.

DESCRIPTION

Disregard, in full, section 1 of the 8400A instruction manual and substitute the following:

The Model 8425A Digital Multimeter (DMM) is a special version of the 8400A, encased in a ruggedized case, with connectors on the rear panel providing connections for power, signal and programming inputs, and digital output signals. A connector is provided on the front panel for signal input connections. A readout display of five full decades, plus a sixth digit for 20% overrange, front panel selection of ranges, functions, and modes of operation plus a current actuated circuit breaker switch are standard features. 1000 volt guarding, full autoranging, instantaneous auto-polarity, and calibration through the top guard cover are standard features of the 8425A.

Fluke's Recirculating - Remainder * A/D conversion technique is in the 8425A. This conversion circuitry periodically samples the input and serially digitizes the sample, providing a reliable DVM with high long-term accuracy and linearity plus superior environmental characteristics.

DC voltages are measured on five ranges with up to 1 microvolt of resolution. 20% overranging with 1100 volt overload capability further characterizes these ranges. A non-blinking readout contains an in-line neon tube display showing polarity, overrange digit, and five full decades of digits followed by a lighted function annunciator. The speed at which the readout updates is controlled by a variable Sample Rate control. Switched four-pole filter has true broad-band noise rejection that cannot integrate a constant offset error into the reading.

AC voltages to 1100 volts are measured on four ranges over a frequency domain of 10 Hz to 100 kHz with up to 10 microvolts resolution. A zero control is not needed to maintain the extremely low "percent of range" portions of the specifications.

True four-terminal resistance measurements on the 10 ohm through 10k ohm ranges are made with very low power dissipation in the unknown resistor. The instrument autoranges through all resistance ranges, from 10 ohms to 12 megohms, with 100 microhm resolution.

Isolated four terminal DC/DC ratios are measured in real time via the DC External Reference assembly. The Reference input LO contact may be elevated by as much as ±13v from the input LO contact without loss of ratio accuracy. Furthermore, the standard reference voltage span of +1V to +10.5V permits measurement of ratios from a wide number of sources. Special reference voltage ranges are available on request.

Three terminal AC/AC ratio measurements use the AC External Reference assembly. Reference voltages from 0.1V to 105V may be applied on one of three internally selected ranges for highly accurate ratio determinations over a broad range of frequencies.

Isolated Data Output and Isolated Remote Control assemblies use guarded toroids to transfer data and commands to and from the 8425A with no degradation of common-mode rejection specifications. These assemblies are also DTL/TTL compatible and are designed to permit multiplexing of several 8425A's on common sets of control and data output lines. Moreover, they are buffered to prevent interaction between the DMM and the acquisition/control devices.

*Patent Pending

External Triggering of the 8425A is accomplished via its Data Output Unit, and resulting data may be acquired fully in parallel BCD format or serially by character in multiples of four-bits. A single control line enables automatic time delays that allow for full settling of the analog input prior to digitization of the data transferred. Five flags provide continuous measurement status information for the acquisition device.

Remote Control is exerted by contact closures or logic levels. The 8425A Control Command Storage feature permits the 8425A to latch on commands which may be later removed from inputs while the 8425A retains the commanded function and range in internal memory. Logical interlocks are a further important systems feature of this option, because they prevent incompatible calls.

SPECIFICATIONS

DC VOLTAGE FILTERED

Full Scale Ranges . . . . . ±.119999V, ±1.19999V, ±11.9999V, ±119.999V, ±1199.99V, (1100V Max.)

Accuracy

24 hours ±1°C . . . . . 0.1V Range ±(0.004% of input +0.005% of range)
1.0V Range ±(0.004% of input +0.002% of range)
10V, 100V
1000V Range ±(0.004% of input +0.001% of range)

6 months . . . . . 0.1V Range ±(0.01% of input +0.005% of range)
1.0V Range ±(0.01% of input +0.002% of range)
10V, 100V
1000V Range ±(0.007% of input +0.001% of range)

Temperature
Coefficient . . . . . 0.1V Range ±(0.0007% of input +0.0005% of range)/°C
0°C to 55°C . . . . . 1.0V Range ±(0.0007% of input +0.0003% of range)/°C
10V, 100V
1000V Range ±(0.0005% of input +0.0002% of range)/°C

Measuring time, Maximum
(settling to full accuracy) . . . . . 500 milliseconds

Normal Mode Rejection . . . . . 60 db min., 50 Hz and up, increasing 24 db/octave;
100 db min., at 400 Hz

Common Mode Rejection - dc . . . . . 140 db with up to 1k ohms in either lead

ac, 60 Hz and below . . . . . 120 db with up to 1k ohms in either lead

Input Resistance
(Meter not overloaded) . . . . . 0.1V Range >100 Megohms
1.0 Range >1000 Megohms
10V Range >10,000 Megohms
100V & 1000V Range 10 Megohms

DC VOLTAGE – FILTER OUT

Measuring time, Maximum (Settling to full accuracy)	25 Milliseconds
Common Mode Rejection - dc	140 db with up to 1k ohm in either lead
ac, 61 Hz and below	90 db with up to 1k ohm in either lead
Normal Mode Rejection	0 db

NOTE: All other dc voltage measurements specifications apply.

FOUR TERMINAL DC/DC RATIO

Reference Voltage	1V to 10.5V
Input Resistance	1 Megohm
Full Scale Ranges	±.119999:1, ±1.19999:1, ±11.9999:1 ±119.999:1, ±1199.99:1
Isolation of Reference Common and the Input Common	V input + common difference voltage not to exceed ±13 volts on the 10 volt and lower ranges

Accuracy

24 hours +1°C	
±1:1, ±10:1, ±100:1 Ranges	±(0.004% of ratio +0.002% x $10V/V_{REF}$ of range)
±0.1:1 Range	±(0.004% of ratio +0.004% x $10V/V_{REF}$ of range)
±0.01:1 Range	±(0.004% of ratio +0.01% x $10V/V_{REF}$ of range)
6 months	
±1:1, ±10:1, ±100.1 Ranges	±(0.005% of ratio +0.002% x $10V/V_{REF}$ of range)
±0.1:1 Range	±(0.005% of ratio +0.004% x $10V/V_{REF}$ of range)
±0.01:1 Range	±(0.005% of ratio +0.01% x $10V/V_{REF}$ of range)
Noise Rejection (at Reference Input)	
Normal Mode	30 db @ 60 Az
Common Mode (with up to 1k unbalance)	120 db – $(20 \log \frac{10V}{V_{REF}}$ db) 120 db @10V REF
Reference Settling Time (to 0.01% of Range)	2 seconds

AC VOLTAGE

Full Scale Ranges	1.19999V, 11.9999V, 119.999V, 1199.99V rms

Accuracy 6 months

	.001V - 500V	500V - 1100V
50 Hz - 10 kHz	± (0.09% of input +0.01% of Range)	±0.1% of input
10 kHz - 50 kHz	± (0.2% of input +0.02% of Range)	±0.15% of input
50 kHz - 100 kHz	± (0.5% of input +0.02% of Range)	
10 Hz - 20 Hz	± (1.0% of input +0.01% of Range)	Same as .001V-500V
20 Hz - 50 Hz	± (0.7% of input +0.02% of Range)	Same as .001V-500V

Temperature Coefficient 0°C to 55°C	(0.002% of input +0.0005% of Range)/°C
Measuring Time, Maximum	
Filter "Out" (Frequency greater than 400 Hz)	100 Milliseconds
Filter "IN" (Any Input Frequency)	500 Milliseconds
Input Impedance	1.11 Megohm in series with 0.22 ufd
Maximum Voltage Rating	Input volts - Hertz Product not to exceed 2×10^7
Common Mode Rejection, 61 Hz and below	100 db with up to 100 ohms in either lead

AC/AC RATIO

Reference Ranges	1V, 10V, 100V (Internal Selection)
Reference Voltages	10% to 105% of Reference Range
Ratio Ranges	
1V	1:1, 10:1, 100:1, 1000:1
10V	0.1:1, 1:1, 10:1, 100:1
100V	.01:1, 0.1:1, 1:1, 10:1
Maximum Voltage Rating (Numerator)	Same as AC

Accuracy, 6 months

50 Hz to 10 kHz 1:1 Range Input and Reference at the same frequency	$\pm\left[0.08\% \text{ of Ratio} + 0.005\% \times \left(\frac{\text{REF Range}}{V_{REF}}\right) \text{ of Range}\right]$

Input and Reference not at same frequency or not on the 1:1 Range . . . . . $\pm\left[0.1\%\text{ of Ratio} + .005\% \times \left(\frac{\text{REF Range}}{V_{REF}}\right)\text{ of Range}\right]$

Temperature Coefficient . . . . . $\pm\left[0.004\%\text{ of Input} + 0.001\% \left(\frac{\text{REF Range}}{V_{REF}}\right)\text{of full scale}\right]$ per °C

Reference Input Impedance . . . . . 1 Megohm in series with 0.22 microfarad

Measuring Time, Max. (Settling to full accuracy) . . . . . 550 Milliseconds

Reading vs. Ratio
- 1V . . . . . 1 x Ratio
- 10V . . . . . 10 x Ratio
- 100V . . . . . 100 x Ratio

OHMS

Full Scale Ranges . . . . . 11.9999, 119.99, 1199.9, 11999, ohms
119.99k, 1199.9k, 11999.k (k = kilohms)

Accuracy, 6 months

- 10 ohms . . . . . ±(0.015% of input +0.01% of range)
- 100, 1k, 10k . . . . . ±(0.015% of input +0.003% of range)
- 100k, 1000k . . . . . ±(0.015% of input +0.002% of range)
- 10000k . . . . . ±(0.08% of input +0.002% of range)

Temperature Coefficient
0°C to 55°C
- 10Ω . . . . . ±(0.001% of input +0.001% of range)/°C
- 100Ω, 1000Ω, 10000Ω . . . . . ±(0.001% of input +0.0002% of range)/°C
- 100k Ω, 1000k Ω . . . . . ±(0.0007% of input +0.0002% of range)/°C
- 10000k Ω . . . . . ±(0.003% of input +0.0002% of range)/°C

Measuring Time, Max. Settling to full accuracy) . . . . . 500 Milliseconds

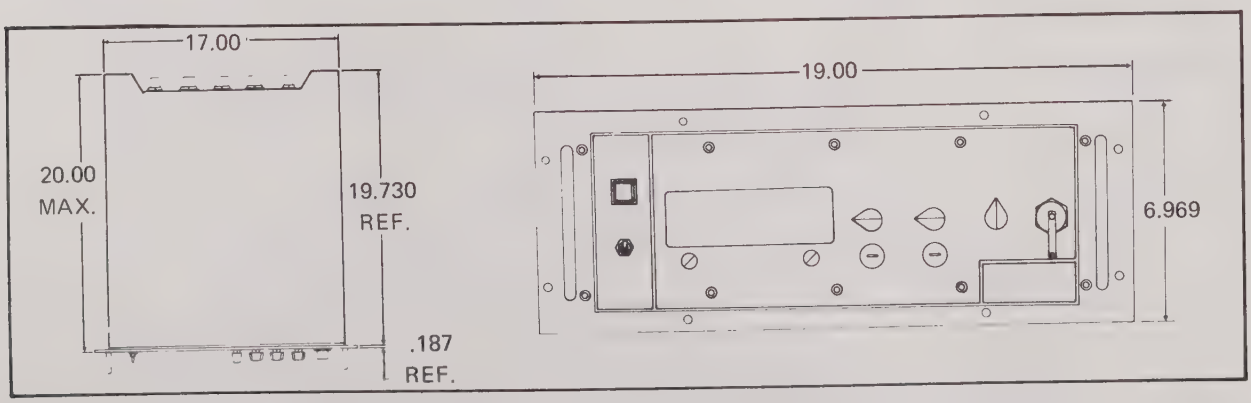


Figure 1. MODEL 8425A OUTLINE DRAWING

Operating Instructions

INTRODUCTION

Most of the information contained within Section 2 of the 8400A manual pertains to the Model 8425A. Noteable differences are as follows:

INSTALLATION

Disregard paragraph 2-4. The following information is to be substituted.

Internal rack slides are mounted on the 8425A inner chassis and the inside portion of the outer case. This allows the 8425A to be pulled out of the outer case without removing connections to rear panel connectors. The outer case can be mounted into a standard 24 inch rack by use of rack slides which are not supplied.

OPTIONS AND ACCESSORIES

There are no options for the 8425A, therefore disregard reference to options. Disregard Table 2-1 and substitute the following table.

Table 1. ACCESSORIES

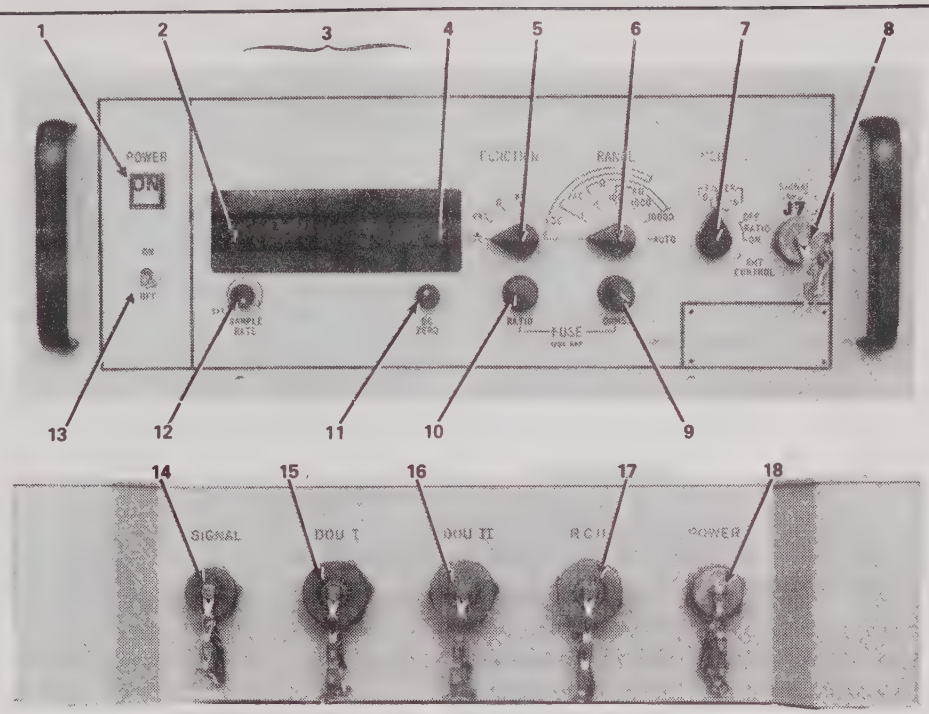
ACCESSORY NO.	NAME
8400A-7014K	Extender Assembly (Required for servicing pcbs)
A90	Current Shunts
80F-5	High Voltage Divider
80F-15	High Voltage Divider
80RF	High Frequency Probe

INPUT POWER REQUIREMENTS

The 8425A operates on 115V, 60 Hz ac power. Disregard paragraph 2-10. Table 2 shows pin connections for J1.

Table 2. J1 PIN CONNECTIONS

FUNCTION	J1 PIN NO.
115V, 60 Hz, HI	A
115V, 60 Hz, LO	B
Chassis Ground	C



REF. NO.	NAME	FUNCTION
1	Power On Lamp	Indicates application of power.
2	Polarity Indicator	Automatic indication of input polarity for dc voltage: "+" for positive input voltages and "–" for negative input voltages.
3	Readout Tubes	Display DVM readout from left to right, with overrange digit displayed in left-most tube. All tubes display a decimal point, depending on range. Full overrange readout on each range would appear as follows: RANGE — READOUT .1 — .119999 1 — 1.19999 10 — 11.9999 100 — 119.999 1000 — 1199.99 10K — 11999.9
4	Function/ Status Annunciator	Indicate instrument function and status as follows: KΩ . . . . DMM operating in kilohm mode. AC . . . . DMM operating in ac voltage mode. DC . . . . DMM operating in dc voltage mode. Ω . . . . . DMM operating in ohms mode. RATIO . . . DMM operating in External Reference mode. FILT . . . . Active 4-pole filter called for maximum noise rejection. OVER . . . DMM input is over the 20% overrange capability. SMPL RATE . Visual indication of sample rate

Figure 2. CONTROL, TERMINAL, AND INDICATORS (Sheet 1 of 3)

REF NO.	NAME	FUNCTION
5	FUNCTION Switch	Select desired DMM operating function: VDC . . . . Places DMM in dc voltage mode with full-scale ranges of .1, 1, 10, 100, and 1000. VAC . . . . Places DMM in ac voltage mode with full-scale ranges of 1, 10, 100, and 1000. Ω . . . . . Places DMM in ohms mode with full scale ranges of 10, 100, 1000, and 10000 if available range is called; otherwise, DMM autofunctions to KΩ. KΩ . . . . . Places DMM in kilohms mode with full scale ranges of 100,1000, and 10000 if available range is called; otherwise, DMM autofunctions to Ω.
6	RANGE Switch	Manual selection of DMM range. Incompatible selection of range with function or selecting Auto position will place DMM in autorange mode.
7	MODE Switch	Select desired DMM operating mode: FILT . . . . Places 4-pole active filter into signal path to provide desired noise rejection. Function for dc voltage, ac voltage, and resistance measurements. RATIO . . . Enables substitution of isolated external reference voltage for internal reference. RMT CONT . Places DMM in remote mode enabling DMM function and range to be controlled remotely via the Remote Control Unit.
8	SIGNAL INPUT J7 Connector	Provides connections for the following inputs: Input HI, LO . Connections for dc and ac voltage measurements , and resistance measurements. Ohms HI, LO . Current source for all resistance measurements. AC Ratio HI, LO Connections for ac/ac ratio measurements. DC Ratio HI, LO Connections for dc/dc ratio measurements. Guard . . . Connects to internal chassis. When properly connected externally, provides maximum common mode rejection.
9	OHMS FUSE	Protects Ohms Converter assembly from overloads. Fuse rating is 1/64A.
10	RATIO FUSE	Protects DC Ratio assembly from overloads. Fuse rating is 1/64A.
11	DC ZERO	Adjusted for .000000 ±1 digit with VDC, FILT, and .1 Range called and Input HI, LO contacts shorted together.
12	SAMPLE	Permits variation of DVM sample rate from 13 readings per second to 1 reading per 4.5 seconds. In EXT position (fully counterclockwise), sample rate control is transferred to remote control point via the Data Output Unit. If the Data Output unit is not installed and the control is turned to EXT, the DVM will read out and display from its internal storage circuitry indefinitely, with readout corresponding to value of last measurement sample.
13	POWER SWITCH	Controls the application of input power, and protects the DMM from overloads.

Figure 2. CONTROL, TERMINAL, AND INDICATORS (Sheet 2 of 3)

REF NO	NAME	FUNCTION
14	J4	Provides signal input connections in parallel with J7.
15	J6	Provides connections for Data Output Unit No. 1.
16	J5	Provides connections for Data Output Unit No. 2.
17	J3	Provides connections for Remote Control.
18	J1	Mates with power cord for connection to 115V, 60 Hz ac line.

Figure 2. CONTROL, TERMINAL, AND INDICATORS (Sheet 3 of 3)

MEASUREMENT INSTRUCTIONS

Disregard reference to Table 2-2 and Table 2-2. The following table is a direct substitute.

Table 3. MEASUREMENT INSTRUCTIONS

MEASUREMENT	FUNCTION	RANGE	INPUT CONNECTIONS	REMARKS
±DC Voltage	VDC	.1, 1, 10, 100, 1000, AUTO	J7, J4 (See Table 4)	DMM autoranges automatically if a range is called that is not compatible with the selected function.
AC Voltage	VAC	1, 10, 100, 1000, AUTO		
Ohms	Ω	10, 100, 1000, 10000, AUTO		Use 4-terminal ohms measurements, if desired, on 10Ω through 10,000Ω ranges. Ohms HI, LO contacts must be connected, either remotely or shorted, for all resistance measurements.
Kilohms	KΩ	100,000 10K, AUTO		
DMM Zero Adjustment	VDC FILT	.1	Short Input HI, LO contacts together. Use a low-thermal shorting link	Adjust front panel DC ZERO control for readout of .000000 ±1 digit.

Add the following table: (Table 4)

Table 4. J7 AND J4 CONNECTIONS

FUNCTION	J7/J4 PIN NO.
Input HI	1
Input LO	8
Ohms HI	2
Ohms LO	9
AC EXT REF HI	3
AC EXT REF LO	7
DC EXT REF HI	10
DC EXT REF LO	12
GUARD	11

EXTERNAL REFERENCE (RATIO)

General

Disregard any reference to option as the AC and DC External Reference capabilities of the 8425A is standard, not optional.

Disregard the last two sentences in paragraph 2-18. Substitute with the following:

Connections for ac and dc reference inputs are available at J7 and J4 and are shown in Table 4.

REMOTE CONTROL UNIT

RCV Command Triggering

Reference to pin 33 and pin 35 in paragraphs 2-28 and 2-29 should be to J3, pin 4 and J3, pin 3 respectively.

Disregard Table 2-5 and reference to Table 2-5 and substitute the following table (Table 5):

Table 5. REMOTE CONTROL UNIT PIN ASSIGNMENTS

FUNCTION	J3 PIN NO.	FUNCTION	J3 PIN NO.
Common	31	VAC	12
Common	32	KΩ	36
Common	21	Ω	33
.1 Range	18	1 Range	28
Common	27	100 Range	22
+5V Input	25	External Reference	15
1000 Range	26	Filter	9
10K Range	20	External Command Entry	4
10 Range	13	Auto Command Defeat	3

Operation

Substitute the following for the last sentence of paragraph 2-31c:

For example, to program 10K ohm, filtered operation, command pins 20, 33, and 9 via contact closure or zero volts to pin 31, 32, or 21 (commons).

DATA OUTPUT UNIT

The following tables replace Table 2-6 and 2-7.

Table 6. RANGE

RANGE	LINE (FUNCTION)		
	11 (a)	6 (b)	31 (c)
10000	0	0	0
1000	0	0	1
100	0	1	0
10	0	1	1
1	1	0	0
.1	1	0	1

Programmed One-Shot

Reference to pin 2 in paragraph 2-41 is incorrect for the 8425A. Reference should be to J5, pin 35.

Code Conversion

Disregard Figure 2-5 of Section 2 and substitute the following figure (Figure 3).

OPERATING NOTES

Overload Protection

In Table 2-8, the information under the heading FORM of PROTECTION for RESISTANCE 10Ω-10,000kΩ ranges and DC EXTERNAL REFERENCE is incorrect for the 8425A. The form of protection is as follows:

FUSE: 1/64 Amp fuse located on front panel.

Table 7. DATA OUTPUT UNIT FUNCTIONAL PIN CONNECTIONS

DATA	CONNECTOR PIN NO. J6	CONNECTOR PIN NO. J5	REMARKS
Primary Function Indicators			Apply logic "0" to gates to inhibit function data outputs.
VDC		29	
VAC		34	
Ω		10	
KΩ		16	
GPF (gate)		12	
Secondary Function Indicators			
Polarity		2	
Filter		26	
Ratio		1	
Remote		5	
GSF (gate)		25	
1st Decade			Logic "0" = Ov Logic "1" = +5V Apply logic "0" to gates to inhibit decade data outputs.
8	8		
4	7		
2	13		
1	20		
G1 (gate)	14		
2nd Decade			
8	27		
4	21		
2	25		
1	18		
G2 (gate)	32		
3rd Decade			
8	4		
4	3		
2	1		
1	2		
G3 (gate)	9		
4th Decade			
8	22		
4	15		
2	16		
1	10		
G4 (gate)	33		
5th Decade			
8	37		
4	29		
2	35		
1	34		
G5 (gate)	36		

DATA	CONNECTOR PIN NO. J6	CONNECTOR PIN NO. J5	REMARKS
Range (coded)			
a	11		
b	6		
c	31		
GR (gate)	24		
Overrange			
"1"	30		
GOR (gate)	17		

Range	Line a	Line b	Line c
10000	0	0	0
1000	0	0	1
100	0	1	0
10	0	1	1
1	1	0	0
.1	1	0	1

Apply logic "0" to gates to inhibit range data outputs.

Control Inputs			
Ext. Trig.		37	
Ext. Trig. Inhibit		36	
Programmed One-Shot		35	
Sample Sync		6	
Flags			Apply logic "0" to gates to inhibit overload and trigger flags.
Busy		23	
Overload		9	
Trigger		4	
GOL (gate)		3	
Power Output			Maximum output: 150 milliamperes at +5 vdc.
+5 vdc		24,30	
Common		11,17	
Code Conversion Terminals			See paragraph 2-42 for code conversion information.
Z_{out}		22	
$\overline{Z}_1$		20	
Z_{in}		14	
Y_{out}		33	
$\overline{Y}_1$		7	
Y_{in}		27	
X_{out}		28	
$\overline{X}_1$		8	
X_{in}		21	
W_{out}		15	
$\overline{W}_1$		18	
W_{in}		32	

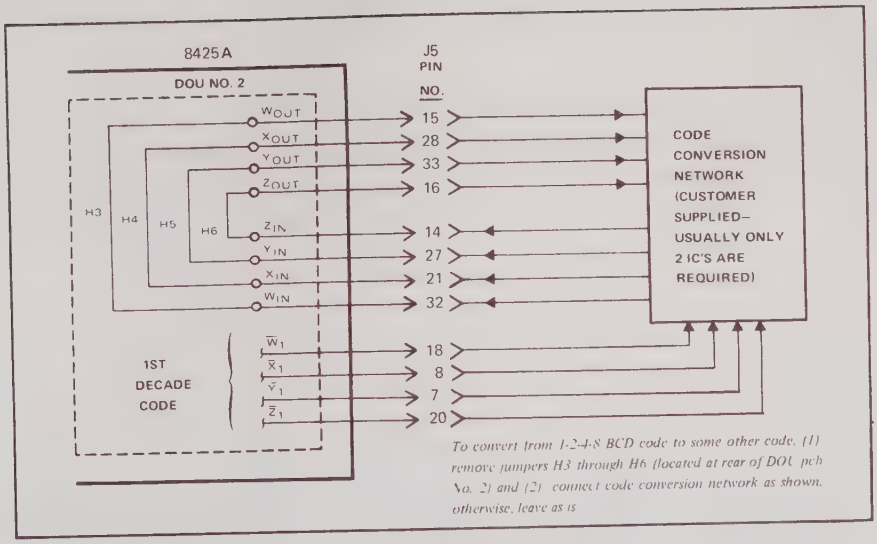


Figure 3. CODE CONVERSION

Theory of Operation

INTRODUCTION

Most of the information contained in Section 3 of the 8400A manual pertains to the Model 8425A with the following exceptions:

Disregard reference to options as the 8400A options are standard features on the Model 8425A. Disregard BLOCK DIAGRAM, Figure 3-1. This is substituted by BLOCK DIAGRAM, DRAWING NO. 8425A-1500 and can be found in front of the Schematics.

Reference to FILTer pushbutton does not pertain to the 8425A. The MODE switch, on the 8425A front panel, selects FILTR IN, OUT settings. Reference to Ω SOURCE and SENSE terminals does not pertain to the 8425A. The Ω SOURCE terminals of the 8400A are the Ohms HI, LO contacts of J7/J4 on the 8425A. Reference to 8400A drawings does not pertain to the 8425A. Model 8400A drawings are substituted by 8425A drawings (example: 8400A-1003 is replaced by 8425A-1003). Reference to EXT REF does not pertain to the 8425A. EXT REF is RATIO for the Model 8425A. The sample rate indicator for the 8425A is within the A15 Function Annunciator.

Disregard the value of R16 in Figure 3-10. The value of this resistor for the 8425A is 100k.

Disregard paragraph 3-79 of Section 3 and substitute with the following:

Input power to the instrument and interconnection of various assemblies is shown in the Wiring and Interconnect Diagrams (Drawing No. 8425A-1000 and 8425A-1100). Line power is applied through and fused by circuit breaker switch S1 to the primary of T1. Secondary windings of T1 provide ac voltages to the A1 Power Supply, A16 Rectifier, and A13 Ohms Converter. Shielding between the primary and secondary windings prevents coupling of any undesired line signals to the internal sections of the instrument. The primary of T1 is tapped to provide 28V to the pilot lamp.

A16 Rectifier

Diodes CR1 through CR4, capacitors C1 and C2 make up the rectifier assembly. The rectifier assembly is a full-wave rectifier and filter, the output of which is applied to the +5 volt supply on Data Output Unit No. 2.

MAINTENANCE

INTRODUCTION

Most of the information contained in Section 4 of the 8400A manual pertains to the Model 8425A. Noteable differances are described as follows. The Performance Test and Calibration sections for the 8425A are located in this supplement.

Disregard paragraphs 4-3, 4-9, 4-10, 4-19 through 4-20, Figures 4-1 through 4-10, and Tables 4-1 through 4-6 and substitute with the following:

A calibration interval of 6 months is recommended to ensure instrument operation within the 6 month specifications as stated in Section 1.

Table 7. REQUIRED TEST EQUIPMENT

EQUIPMENT NOMENCLATURE	RECOMMENDED EQUIPMENT	FUNCTION
DC Calibrator	FLUKE Model 332D DC Voltage Standard	Performance Test Calibration Troubleshooting
DVM Calibrator	FLUKE Model 343A DVM Calibrator	Performance Test
Kelvin Varley Divider	FLUKE Model 720A	Performance Test Calibration
Differential Voltmeter Battery Operated	FLUKE Model 885AB	Performance Test Calibration Troubleshooting
Oscilloscope	Tektronix Model 547A	Performance Test Calibration Troubleshooting
Oscilloscope Plug-IN	Tektronix Model 1A1	Performance Test Calibration Troubleshooting
Oscilloscope Probe	Tektronix Model P6010	Calibration
AC Voltage Source	Hewlitt Packard Model 745 and 746	Performance Test Calibration Troubleshooting
Standard Resistors	10 Ω ±30 PPM 100 Ω ±30 PPM 1KΩ ±20 PPM 10KΩ ±20 PPM 100KΩ ±20 PPM 1MΩ ±20 PPM 10MΩ ±100 PPM	Performance Test Calibration Troubleshooting

Access/Disassembly

The following procedure is used to gain access to the interior of the Model 8425A.

a. Remove 10 screws which secure the front panel and inner chassis to the outer case.

b. Pull instrument out of case until the top guard chassis cover is completely clear of case. Access is now gained to calibration adjustments and test points.

c. Remove top guard chassis cover by removing the six screws which secure it to the inner chassis. Access is now provided to the plug-in assemblies shown in Figure 4.

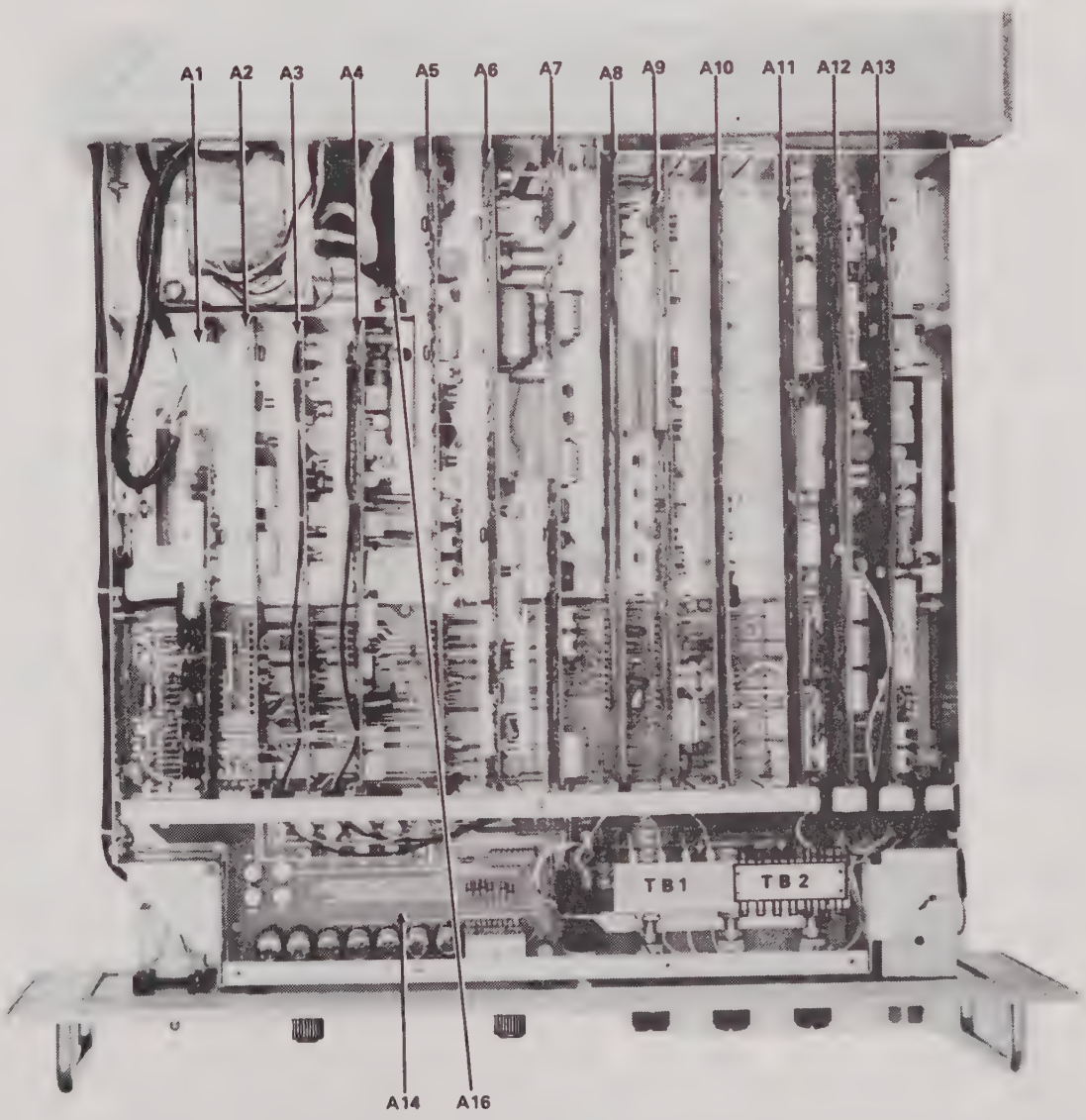


Figure 4. ASSEMBLY LOCATIONS

d. Remove bottom guard cover by removing six screws which secure it to inner chassis. Access is now provided to the bottom section of the Model 8425A.

e. To remove inner chassis from case all connections, via connectors inside the case, must be disconnected prior to pulling inner chassis out of case.

Fuse Replacement

Two fuses are located on the A14 Display board. Access to these fuses is from the front panel. When replacement is necessary, install TYPE 8AG, 1/64A.

Lamp and Tube Replacement

The POWER ON light is replaced as follows:

a. Grasp the outside edges of the POWER ON light and pull out of front panel.

b. Replace defective bulb with spare bulb located in POWER ON light block.

c. Insert the POWER ON light block back into holder on front panel.

PERFORMANCE TEST

The performance test in this supplement compares the performance of all functions of the Model 8425A to the accuracy specifications in this supplement. The Performance Tests should be conducted prior to any instrument maintenance or calibration attempts. These tests are also suited to receiving inspection of new instruments. The performance tests should be conducted under the following conditions: Ambient Temperature 23°C ±5°C, Relative Humidity less than 70%.

Should an instrument fail the performance test corrective maintenance or calibration will be required. In the case a trouble occurs, analysis of the test results, with reference to the Troubleshooting Section, should help to locate the trouble.

In the following procedure dc voltages are applied to the instrument at 10% and 100% of full scale on the .1, 1, 10, 100 and 1000 volt ranges.

Preliminary Operation

a. Connect the Model 8425A to the ac line and set the controls as follows:

POWER	ON
FUNCTION	VDC
RANGE	.1
MODE	FILTR IN

Readout Checks

a. Short INPUT contacts, J7 pins 1 and 8, together .

b. Adjust the front panel ZERO control for a minimum reading on the Model 8425A display.

c. Connect equipment as shown in Figure 5.

d. Set the calibrator to 10.0000V output on 10V range.

e. Refer to Table 8 for K-V divider settings and corresponding readout limits on Model 8425A.

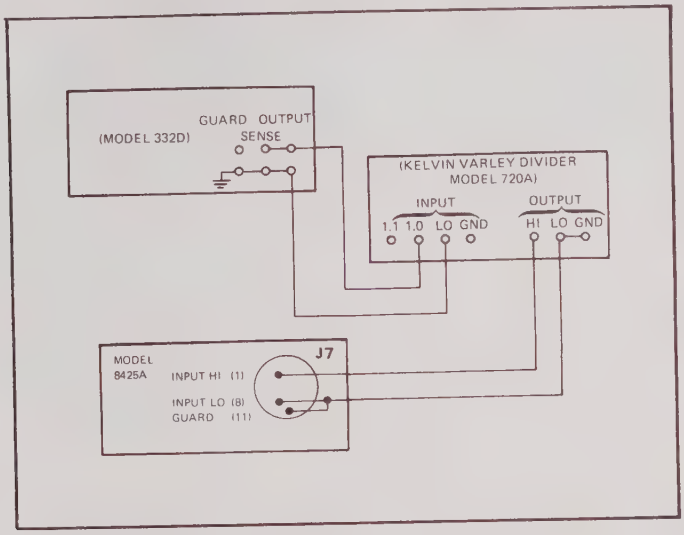


Figure 5. READOUT CHECK EQUIPMENT CONNECTION

Table 8. DC TEST REQUIREMENTS (.01V to 1V)

K-V Divider SETTINGS	MODEL 8425A	
	RANGE	READOUT LIMITS
.0010000	.1	+009994 to .010006
.0100000	.1	.099985 to .100015
.0100000	1	+0.09997 to 0.10003
.1000000	1	+0.99988 to 1.00012
.1000000	10	+0.9998 to 1.0002

f. Reverse input leads to Model 8425A.

g. Repeat step e. The DMM readout limits are the same as for positive inputs, except that the polarity indication will be negative (−).

h. Disconnect equipment and connect calibrator to Model 8425A.

i. Apply each of the input voltages shown in Table 9 to the INPUT contacts of the Model 8425A. The readout must be as indicated.

j. Repeat step i, with negative input voltages. The DMM readout limits must be the same as for positive inputs, except that the polarity indication will be negative (−).

Table 9. DC TEST REQUIREMENTS (10V, 100V, AND 1000V)

INPUT (Volts DC)	MODEL 8425A		
	RANGE	READOUT LIMITS	READOUT TOLER-ANCES
+10.0000	10	+9.9992 to 10.0008	±.0008
+10.0000	100	†09.998 to 10.002	±.002
+100.000	100	+99.992 to 100.008	±.008
+100.000	1000	+099.98 to 100.02	±.02
+1000.00	1000	+999.92 to 1000.08	±.08

k. Apply zero volts to the INPUT contacts of the DMM and set range switch to AUTO. The readout must be .000000 ±.000005.

l. Apply +1000.00 volts dc to the INPUT contacts. The DMM must range automatically and the readout must be +1000.00 ±.05.

AC Voltage Test

In the following procedure, 10 kHz voltages are applied to the instrument at 100% of full-scale on the 1, 10, and 100 volt ranges and at 0.1% and 100% of full-scale on the 1000 volt range.

a. Set the DMM controls as follows:

FUNCTION VAC
RANGE Manually selected, as required.

b. Apply each of the 10 kHz test signals shown in Table 10 to the INPUT terminals of the DVM. The readout should be as indicated.

Table 10. AC VOLTAGE TEST REQUIREMENTS

INPUT (VAC)	RANGE	READOUT LIMITS
1	1	.99900 to 1.00100
10	10	9.9900 to 10.0100
100	100	99.900 to 100.100
1	1000	000.90 to 001.10
1000	1000	999.00 to 1001.00

Ohms Converter Tests

KILOHMS TEST. The kilohms function is checked at full scale on each of three ranges of the DMM. Connect each of the standard resistors shown in Table 11, in turn, to the INPUT contacts of the Model 8425A. Use short, low-resistance connecting leads. Set the DMM controls as shown in the Table. The readout should be as indicated.

OHMS TEST. The ohms function is checked at full scale on each of four ranges on the DMM. Connect equipment as shown in Figure 6. Connect each of the standard resistors in Table 12, observing appropriate readout as indicated.

Table 11. KILOHMS TEST REQUIREMENTS

STANDARD RESISTANCE	MODEL 8425A		
	FUNCTION	RANGE	READOUT LIMITS
100K Ω	KΩ	100	099.983 to 100.017
1000K Ω	KΩ	1000	0999.83 to 1000.17
10M Ω	KΩ	10K	09991.8 to 10008.2

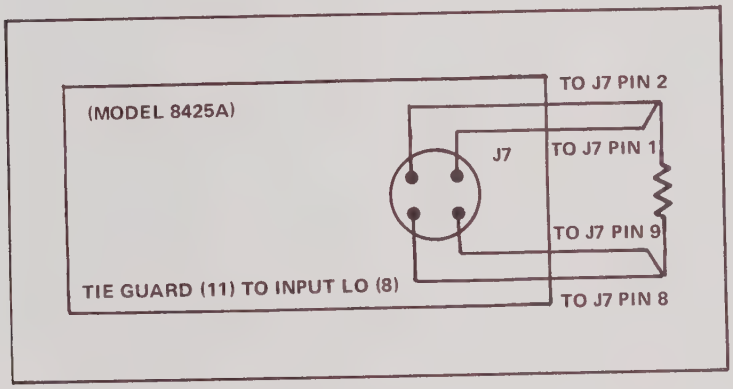


Figure 6. EQUIPMENT CONNECTION FOR OHMS TEST

Table 12. OHMS TEST REQUIREMENTS

STANDARD RESISTANCE	MODEL 8425A		
	FUNCTION	RANGE	READOUT LIMITS
10Ω	Ω	10	9.9975 to 10.0025
100Ω	Ω	100	99.982 to 100.018
1K Ω	Ω	1000	999.82 to 1000.18
10K Ω	Ω	10K	9998.2 to 10001.8

Remote Control Unit Tests

To test the RCU, proceed as follows:

a. Supply +5 volts dc to the RCU, J3 pin 25 (+5V dc) and J3 pin 21, 31, or 32.

b. Set MODE switch to RMT CONT on the Model 8425A front panel.

c. Short INPUT contacts together. INPUT contacts are J7/J4 pin 1 (HI) pin 8 (LO).

d. Activate each of the combination of functions and ranges shown in column 1 and 2 of Table 13 by contact closure between the appropriate pin and common of the RCU connector (refer to Table 5

of this Supplement for connector pin assignments). Observe the resulting front panel display and verify correct response for each call combination listed in Table 13.

Table 13. REMOTE CONTROL UNIT TEST REQUIREMENTS

COMMANDED		DMM RESPONSE												
		FUNCTIONS							RANGES					
FUNCTIONS	RANGES	DC	AC	KΩ	Ω	RATIO	FILT	OVER	.1	1	10	100	1000	10K
FILT, EXT REF	.1	0				0	0		0					
	1	0				0	0			0				
	10	0				0	0				0			
	100	0				0	0					0		
	1000	0				0	0						0	
	AUTO	0				0	0		Down ranges from 1000 to .1					
FILT, EXT REF, Ω	10				0		0				0			
	100				0		0					0		
	1000				0		0						0	
	10K				0		0							0
FILT, EXT REF, KΩ	100			0			0					0		
	1000			0			0						0	
	10K			0			0							0
	AUTO			0			0		Autoranges in the following order; 10000K, 1000K, 100K, 10Ω and Stop					
EXT REF, VAC	1		0			0				0				
	10		0			0					0			
	100		0			0						0		
	1000		0			0							0	
	AUTO		0			0			Downranges from 1000 to 1.					

Data Output Unit Tests

DIGITS REGISTRATION

a. Set Model 8425A controls as follows:

FUNCTION VDC
RANGE 10
SAMPLE RATE EXT (sample as required)

b. Connect a +1.1111 volt dc test signal to the INPUT contacts.

c. Command the DMM to take a reading. The DOU output and the front panel display should indicate DC +1.1111.

d. Repeat steps (b) and (c) for test signal inputs of +2.2222, +4.4444, and +8.8888 volts dc. The DOU output and front panel display should correspond.

OVERLOAD INDICATOR

a. Set Model 8425A controls as follows:

FUNCTION	VDC
RANGE	10
SAMPLE RATE	EXT (sample as required)

b. Connect a +20 volt dc test signal to the INPUT contacts.

c. Command the DMM to take a reading by applying one external sample pulse. The DOU outputs and front panel display should indicate DC +11.9999 and OVERload.

FUNCTION REGISTRATION

a. Set Model 8425A controls as follows:

FUNCTION	VAC
RANGE	100
SAMPLE RATE	EXT

b. Short the INPUT HI, LO CONTACTS together.

c. Apply one external sample pulse. The DOU outputs and front panel display should indicate VAC and a readout of 00.000 ±2 digits.

d. Repeat steps (a) through (c) for each of the following DMM functions. The DOU output and front panel display should be as indicated.

FUNCTION	DOU OUTPUT/DDM DISPLAY
KΩ	KΩ, 00.000
10 Ω	Ω, 0.0000
VDC, FILT, EXT. REF.	VDC, 00.000 FILT, RATIO

OUTPUT GATES

a. Set Model 8425A controls as follows:

FUNCTION	VDC
RANGE	10
SAMPLE	EXT

b. Connect a −0.0010 volt dc test signal to the INPUT contacts.

c. Command the DMM to take a reading. The DOU output and DMM display should indicate DC − 0.0010 ±2 digits.

d. Short all of the following DOU output gate terminals to ground (J5 pin 11 or 17). the DOU output should be as indicated.

GATE TERMINALS (PIN AND CONNECTOR)	DOU OUTPUT
J5 - 12	DC, FILT, EXT.
J5 - 25	REF, AC, Ω, KΩ,
J5 - 3	REMOTE CONTROL,
J6 - 34	OVERLOAD, EXT.
J6 - 17	TRIG.
J6 - 32	and readout of 1555.55
J6 - 9	
J6 - 36	
J6 - 20	
J6 - 33	

PROGRAMMED ONE SHOT.

a. Set the Model 8425A controls as follows:

FUNCTION	VDC,
MODE	FILTR IN
RANGE	100
SAMPLE RATE	EXT (rate should be approximately 1 sample/5 seconds).

b. Connect oscilloscope to ready lin, J5 pin 23. Command instrument to sample. Delay length should be 523 ±20 milliseconds.

c. Set the function and range controls as follows. The delay lengths should be as indicated.

	POS Operative	Function Calls	Range Call	Observe Length (ms)
a.	Yes	VDC, FILT IN	100	535 ±32 ms
b.	"	VAC, FILT IN	"	535 ±54 ms
c.	"	Ω, FILT IN	"	535 ±54 ms
d.	"	KΩ, FILT IN	"	535 ±54 ms
e.	No	KΩ, FILT IN	"	66 ±15 ms
f.	Yes	VDC	1	135 ±22 ms
g.	"	VDC	100	66 ±15 ms
h.	"	VAC	"	135 ±22 ms
i.	"	Ω	"	135 ±22 ms
j.	"	KΩ	"	85 ±18 ms

DC Ratio Tests

To test the DC RATIO unit, proceed as follows:

a. Connect the dc voltage source to the Model 8425A as shown in Figure 7.

b. Set the Model 8425A controls as follows:

POWER	ON
FUNCTION	VDC
RANGE	10
MODE	RATIO ON

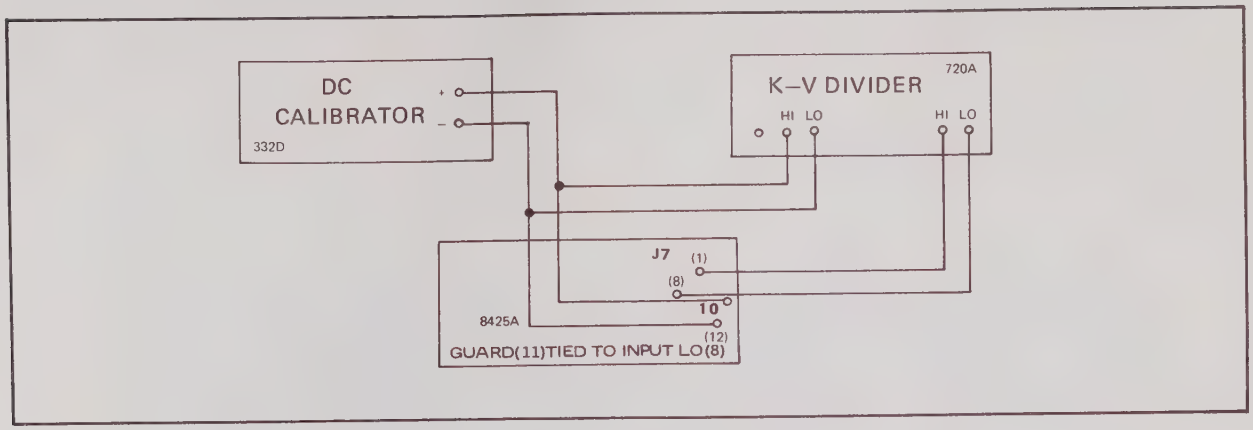


Figure 7. EQUIPMENT CONNECTIONS FOR DC RATIO TEST

c. Set the dc voltage source controls for 10 volt dc output.

d. The Model 8425A readout should be +10.0000 ±0.0007.

e. Reverse the input to the DMM only. DMM readout should be within 2 digits of value recorded in step (c).

f. Reverse the input to the DMM only. Change the dc source output to 5.0000 volts.

g. Readout 8.0050 on DMM display ±4 digits.

AC Ratio Tests

To test the AC RATIO unit, proceed as follows:

a. Connect the AC Voltage source to the Model 8425A as shown in Figure 8.

b. Set the DMM controls as follows:

FUNCTION	VAC
RANGE	Manually selected, as required.
MODE	RATIO ON

c. Apply each of the test signals shown in Table 14 to the INPUT contacts of the DMM. The readout should be as indicated.

Table 14. AC RATIO TEST REQUIREMENTS

STEP	INPUT		RANGE		READOUT
	FREQ	VOLTS	8425A	*A4S1	
1	10 kHz	100	100	100	100.000 ±.085
2	10 kHz	10	100	100	100.000 ±.130

*NOTE: A4S1 IS LOCATED INSIDE CASE, MOUNTED ON A4 (AC EXTERNAL REFERENCE CONVERTER) ASSEMBLY.

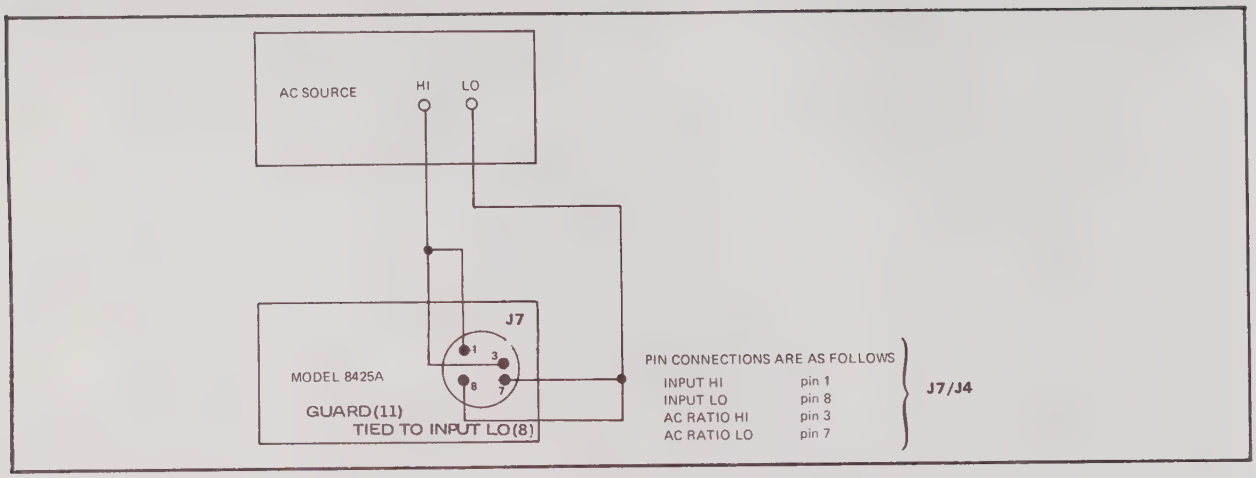


Figure 8. EQUIPMENT CONNECTION FOR AC RATIO TEST

CALIBRATION PROCEDURE

Introduction

The 8425A should be calibrated every 6 months in order to maintain rated accuracy or whenever repairs have been made. Calibration should be done under the following conditions: Ambient Temperature of 23°C ±2°C, Relative Humidity less than 70%. Refer to Table 7 in this Supplement for recommended test equipment. Adjustment and test point locations are labeled on the top inner guard chassis cover. Figure 9 shows adjustment and test point locations with the top inner guard cover on.

Preliminary Operations

a. Remove the 10 screws that secure the front panel to the case.

b. Connect line cord to the output of an autotransformer set to 115V ac.

c. Turn on the Model 8425A and allow it to warm-up for one hour.

Buffer Zero Adjustment

a. Set the Model 8425A controls as follows:

MODE	FILTR ON
FUNCTION	VDC
RANGE	.1

b. Short the INPUT contacts, J7 pins 1 and 8, together.

c. Adjust front panel ZERO control for a reading of ZERO ±1 microvolt on the Model 8425A.

d. Pull inner chassis out so that all adjustments are accessable

Bias Current Adjustment

a. Remove short across input contacts and replace with 1 megohm resistor in parallel with a .22 uf capacitor.

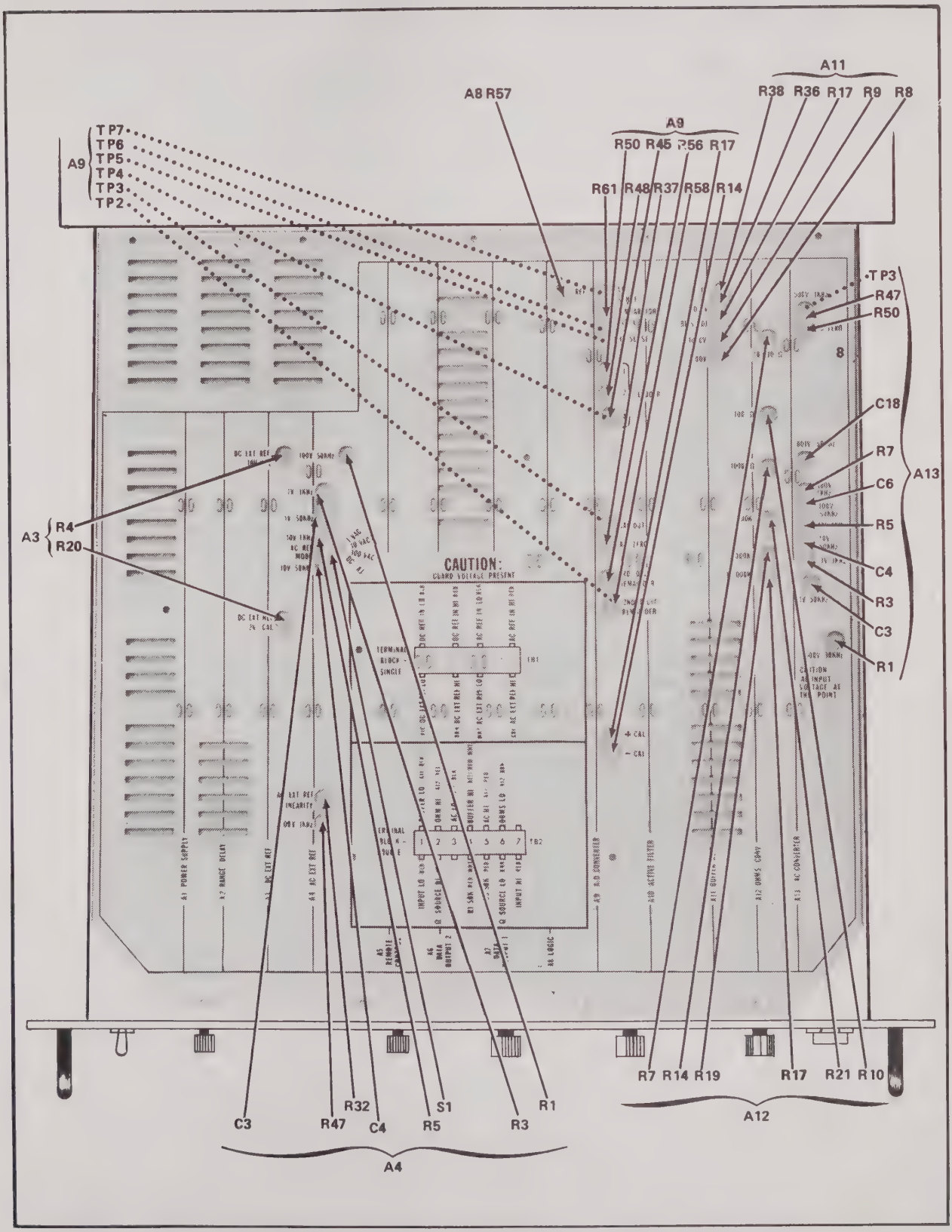


Figure 9. ADJUSTMENT AND TEST POINT LOCATIONS

b. Adjust BIAS (A11R17) on A11 for a zero ±3 microvolt readout on the Model 8425A display.

c. Repeat steps (b) and (c).

Reference Voltage Adjustment

a. Connect the differential voltmeter to LO SENSE (A9TP7) and HI SENSE (A9TP5).

b. Adjust REF (A8R57) for a reading of 7.00000 ±25 uV on the differential voltmeter. Remove short from the INPUT contacts.

A-D Zero Adjustment

a. Connect the HI of the differential voltmeter to CAL OUT (A9TP3).

b. Set the differential voltmeter as follows:

RANGE	1V
NULL SENSE	.1
READOUT	.550000

c. Set the Model 8425A as follows:

FUNCTION	VDC
MODE	FILTR IN
SAMPLE RATE	FULL CW
RANGE	10

d. Connect test equipment as shown in Figure 10.

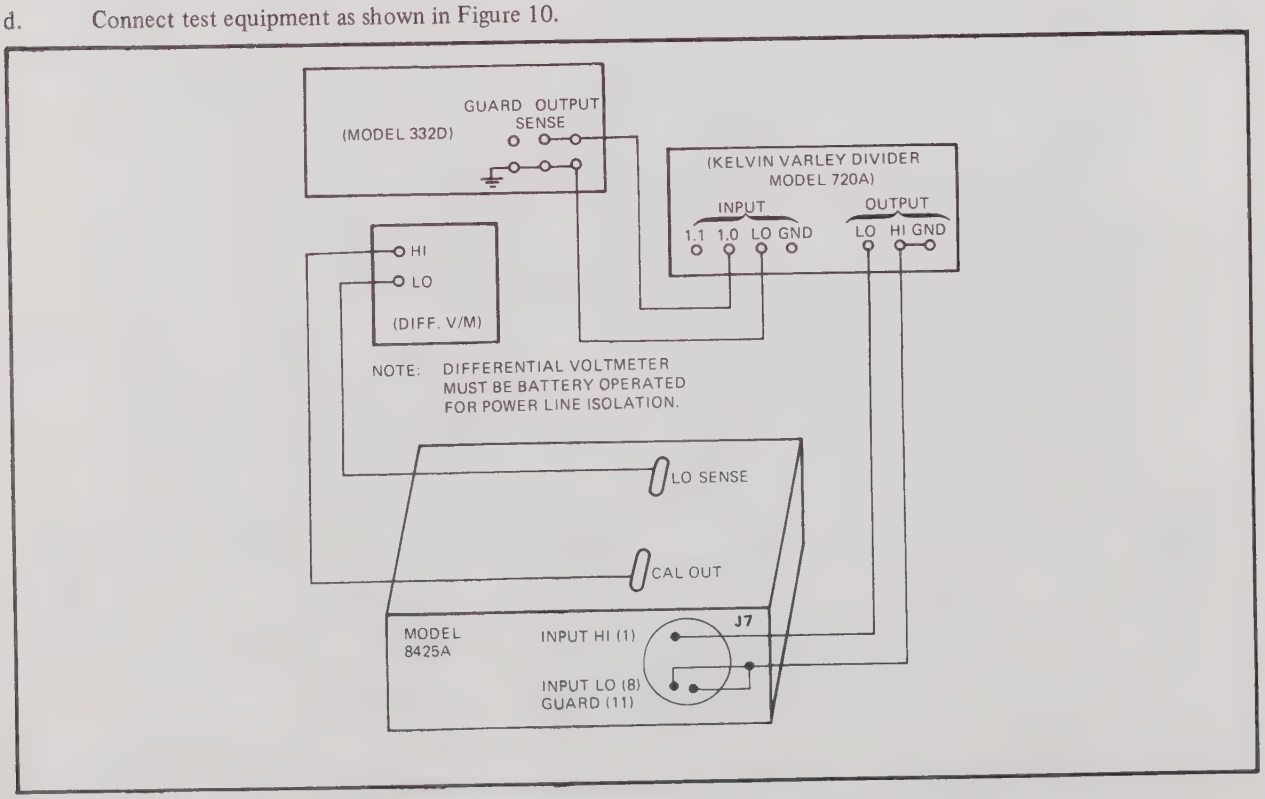


Figure 10. EQIPMENT CONNECTION FOR CALIBRATION

e. Set the calibrator to 10.0000V output on 10V range and dial .00005 on 720A.

f. Adjust A-D ZERO (A11R37) for a readout of +0.0005V on the Model 8425A nixie display. Refine the adjustment for a null (zero) reading on the differential voltmeter. Reverse the input to the Model 8425A and observe –0.0005V on the display and that the reading on the differential voltmeter changes less than ±4 major divisions.

+ Cal Adjustment

a. Connect equipment as shown in Figure 10.

b. Adjust COMPARATOR LEVEL (A9R61) to full cw.

c. Dial .800052 on divider.

d. Adjust + CAL (A11R17) for a readout of +8.0005 on Model 8425A display.

e. Refine the adjustment for a null (zero) on the differential voltmeter.

Ladder Cal

a. Connect equipment as shown in Figure 10.

b. Apply the input voltages given in Table 15 and perform the associated adjustments that produce the required readout on the Model 8425A and differential voltmeter.

Table 15. LADDER CALIBRATION

LADDER NO.	MODEL 8425A			DIFF. V/M READOUT
	K-V Divider	Adjustment	READOUT	
4	+.400052V	LADDER 4 (A9R45)	+4.0005V	NULL
2	+.200052V	LADDER 2 (A9R48)	+2.0005V	NULL
1	+.100052V	LADDER 1 (A9R50)	+1.0005V	NULL

Negative Cal Adjustment

a. Set divider to .8000520.

b. Reverse input to the Model 8425A.

c. Adjust –CAL (A9R14) for a display readout of –8.0005.

d. Refine the adjustment for a null (zero) on the differential voltmeter.

Remainder Adjustment

a. Set COMPARATOR LEVEL (A9R61) full ccw.

b. Connect equipment as shown in Figure 10.

c. Apply the input voltages given in Table 16 and perform the associated adjustments that produce the required readout of the Model 8425A and differential voltmeter.

Table 16. COMPARATOR LEVEL ADJUSTMENT

DIGIT NO.	K-V Divider SETTING	MODEL 8425A		DIFF. V/M READOUT
		Adjustment	READOUT	
2	+.090052V	2nd Digit Remainder (A9R58)	+0.9005	NULL
3	+.099052V	3rd Digit Remainder (A9R56)	+0.9905	NULL
4	+.099952V	—	+0.9995	±2 Major Divisions

Comparator Level Adjustment

a. Connect equipment as in Figure 10, but do not connect up the differential voltmeter.

b. Set divider to .099995.

c. Adjust COMPARATOR LEVEL (A9R61) so display readout alternates between +0.9999 and +1.0000.

d. Alternate a dc input to the Model 8425A between +1.9999V and +2.0000V dc and verify that the display readout corresponds.

Buffer DC Calibration

a. Apply the dc input voltages given in Table 17 and adjust the associated control for a corresponding readout.

Table 17. BUFFER CALIBRATION

DC INPUT VOLTAGE	MODEL 8425A		
	RANGE	ADJUSTMENT	READOUT
+100.000	100	100V (A11R8)	+100.000
+1000.00	1000	1000V (A11R9)	+1000.00
+1.00000	1	1V (A11R36)	+1.00000
+.100000	.1	0.1V (A11R38)	+.100000

AC Converter Calibration

AC CONVERTER BIAS ADJUSTMENTS

a. Set the DMM controls as follows:

FUNCTION	VAC
RANGE	1
SAMPLE RATE	Fully clockwise

b. Connect the GUARD contact to the LO input contact.

c. Connect a shorting jumper between the input contacts.

d. Remove the inner guard cover.

e. Connect a differential voltmeter, HI to A13 TP1 and common to the DMM LO input contact.

f. Adjust A13 R30 for zero volts dc ±10mV.

g. Remove the shorting jumper from the input contacts.

h. Apply 10V at 1kHz to the input contacts.

i. Adjust A13 R32 for a differential voltmeter reading of zero volts dc ±10 mV.

j. Remove the differential voltmeter and AC voltage source connections and replace the inner guard cover.

AC CONVERTER ALIGNMENT

a. Set the DMM controls as follows:

FUNCTION	VAC
RANGE	1000
SAMPLE RATE	Fully clockwise

b. Connect the GUARD contact to the LO input contact.

c. Connect a shorting jumper between the input contacts.

d. Adjust AC zero for 000.00 on the readout.

e. Remove the short between the INPUT contacts.

f. Perform the checks and adjustments contained in Table 18.

Table 18. AC CONVERTER RANGE CALIBRATION

STEP	INPUT		RANGE	ADJUSTMENT	TOLERANCE (± DIGITS)
	FREQ	VOLTS			
1	1 kHz	.001	1	Check Only	3
2	50 kHz	.001	1	.001V 50 kHz (A13C18)	Same reading as Step 1
3	1 kHz	500.00	1000	500V 1 kHz (A13R47)	3
4	30 kHz	500.00	1000	500V 30 kHz (A13C2)	3
5	1 kHz	1.0000	1	1V 1 kHz (A13R3)	5
6	50 kHz	1.0000	1	1V 50 kHz (A13C3)	5
7	100 kHz	1.0000	1	Check Only	200
8	20 kHz	1.0000	1	Check Only	20
9	50 Hz	1.0000	1	Check Only	30
10	1 kHz	10.0000	10	10V 1 kHz (A13R5)	5
11	50 kHz	10.0000	10	10V 50 kHz (A13C4)	5
12	100 kHz	10.0000	10	Check Only	200
13	1 kHz	100.000	100	100V 1 kHz (A13R7)	5
14	50 kHz	100.000	100	100V 50 kHz (A13C6)	5
15	20 kHz	100.000	100	Check Only	20
16	10 kHz	1000.00	1000	Check Only (wait 30 sec.)	50

Ohms Converter Calibration

a. Set the Model 8425A controls as follows:

MODE	FILTR IN
FUNCTION	VDC
RANGE	.1
SAMPLE RATE	full clockwise

b. Connect the GUARD contact to the LO INPUT contact and the OHMS HI contact to the HI INPUT contact, and the OHMS LO contact to the LO INPUT contact.

c. Short the INPUT contacts together.

d. Adjust the DC ZERO control on the front panel for a zero ±1 microvolt readout.

KILOHMS CALIBRATION

a. Set FUNCTION switch to KΩ and RANGE switch to 10K.

b. Remove the short between the INPUT contacts.

c. Connect the resistances indicated in Table 19 between the INPUT contacts and perform the corresponding adjustment.

Table 19. KΩ RANGE CALIBRATION

STANDARD RESISTANCE	RANGE	ADJUSTMENT	READOUT
10M	10K	10000K (A12R17)	10.0000
1M	1000	1000K (A12R19)	1000.00
100K	100	100K (A12R21)	100.000

NOTE!

The readout indicated in Table 19 should match the exact value of the calibration resistor, not the nominal value.

OHMS CALIBRATION

a. Remove short between the INPUT HI and OHMS HI contacts, and between INPUT LO and OHMS LO contacts.

b. Connect equipment as shown in Figure 11.

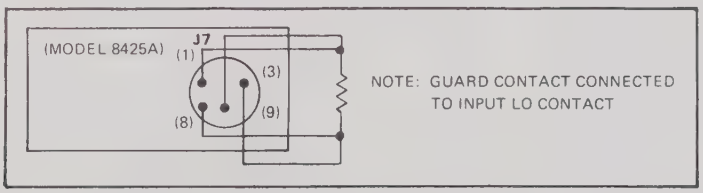


Figure 11. EQUIPMENT CONNECTION FOR OHMS CALIBRATION.

c. Set MODE switch to Ω and RANGE switch to 10K.

d. Connect the resistance indicated in Table 20 as shown in Figure 2 and perform the corresponding adjustment.

e. Short OHMS HI to INPUT HI and OHMS LO to INPUT LO.

Table 20. OHMS RANGE CALIBRATION

STANDARD RESISTANCE	RANGE	ADJUSTMENT	READOUT
10K	10K	10000 Ω (A12R7)	10000.0
1K	1000	1000 Ω (A12R14)	1000.00
100 Ω	100	100 Ω (A12R10)	100.000
10 Ω	10	NONE	10.000 ±.006*
NOTE * IF MORE THAN ±.006 RESET VDC ZERO AND RECALIBRATE OHMS RANGES.			

DC Ratio Calibration

DC RATIO ALIGNMENT

a. Connect equipment as shown in Figure 12.

b. Set Model 8425A controls as follows:

FUNCTION	VDC
RANGE	10
SAMPLE RATE	as desired
MODE	RATIO IN

c. Set the 720A dials to 800500.

d. Set the 332D output to 10.00000 volts.

e. Adjust DC EXT REF 10V CAL (A3R4) for a readout of 8.0050.

f. Set the 332D output to 2.000000 volts.

g. Adjust DC EXT REF 2V CAL (A3R20) for a readout of 8.000 ±1 digit.

h. Repeat steps (b) through (f), as required, until no more adjustment is necessary.

i. Disconnect calibration equipment from Model 8425A.

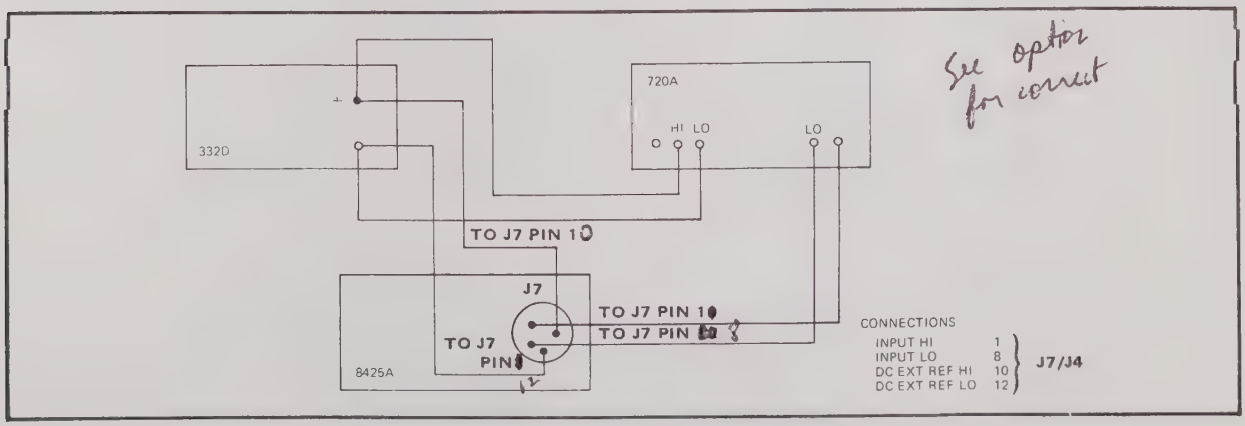


Figure 12. EQUIPMENT CONNECTIONS FOR DC RATIO CALIBRATION

AC Ratio Calibration

AC CONVERTER ALIGNMENT

a. Set the DMM controls as follows:

FUNCTION	VAC
RANGE	100
SAMPLE RATE	Fully clockwise
MODE	FILTR IN

b. Connect the GUARD contact to the LO input contact.

c. Connect a shorting jumper between the input contacts.

d. Adjust AC ZERO (A13R50) for 000.00 on the readout.

e. Remove the short between the INPUT contacts.

f. Connect AC RATIO input and front panel INPUT together and apply 100V 1 kHz to the input. Turn external reference on from front panel. Readout should be near full scale (uncalibrated). While changing input between 100V and 30V) adjust the EXT. REF. linearity, A4R32, for the same reading, ±1 digit, with either voltage.

g. Perform the checks and adjustments contained in Table 21.

Table 21. AC RATIO RANGE CALIBRATION

STEP	INPUT		RANGE 8425A	S1	ADJUSTMENT	TOLERANCE (± DIGITS)
	FREQ	VOLTS				
1	1 kHz	100.000	100	100	100V 1 kHz (A4R47)	5
2	50 kHz	100.000	100	100	100V 50 kHz (A4C2)	5
3	20 kHz	100.000	100	100	Check Only	5
4	1 kHz	10.0000	10	10	10V 1 kHz (A4R5)	5
5	50 kHz	10.0000	10	10	10V 50 kHz (A4C4)	5
6	100 kHz	10.0000	10	10	Check Only	100
7	1 kHz	1.0000	1	1	1V 1 kHz (A4R3)	5
8	50 kHz	1.0000	1	1	1V 50 kHz (A4C3)	5
9	100 kHz	1.0000	1	1	Check Only	100
10	20 kHz	1.0000	1	1	Check Only	5

LIST OF REPLACEABLE PARTS

The following parts listing are 8425A assemblies.
The parts listings are in the same format as the 8400A.

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	DIGITAL MULTIMETER	8425A					
	Figure 13 (Sheet 1 of 6) for the locations of the following parts:						
A1	Power Supply (Figure 14)	326702	89536	326702	1		
A2	Range Delay (Figure 15)	326751	89536	326751	1		
A3	DC External Reference (Figure 16)	326785	89536	326785	1		
A4	AC External Reference (Figure 17)	326777	89536	326777	1		
A5	Remote Control Unit (Figure 18)	326801	89536	326801	1		
A6	Data Output No. 2 (Figure 19)	326850	89536	326850	1		
A7	Data Output No. 1 (Figure 20)	326850	89536	326850	1		
A8	Logic (Figure 21)	326868	89536	326868	1		
A9	A/D Converter (Figure 22)	326868	89536	326868	1		
A10	Active Filter (Figure 23)	326843	89536	326843	1		
A11	Buffer Amp (Figure 24)	326744	89536	326744	1		
A12	Ohms Converter (Figure 25)	326793	89536	326793	1		
A13	AC Converter (Figure 26)	326769	89536	326769	1		
A14	Display and Interconnect (Figure 27)	311514	89536	311514	1		
A16	DOU Power PCB (Figure 28)	333427	89536	333427	1		
1	Cover, Top guard	303289	89536	303289	1		
2	Screw, PHP 4-40X 5/16	335141	89536	335141	16		
3	Screw, 6 - 32 x 5/8 FHP	335158	89536	335158	10		
4	Case, Rack mount	408823	89536	408823	1		
	Connector Plug	327809	89536	327809	1		
	Connector Plug	327841	89536	327841	1		
	Connector Plug	327858	89536	327858	1		
	Connector Plug	327866	89536	327866	1		
	Connector Plug	327924	89536	327924	1		
	See Figure 13 (Sheet 2 of 6) for the locations of the following parts:						
5	Insulator shield	284323	89536	284323	2		

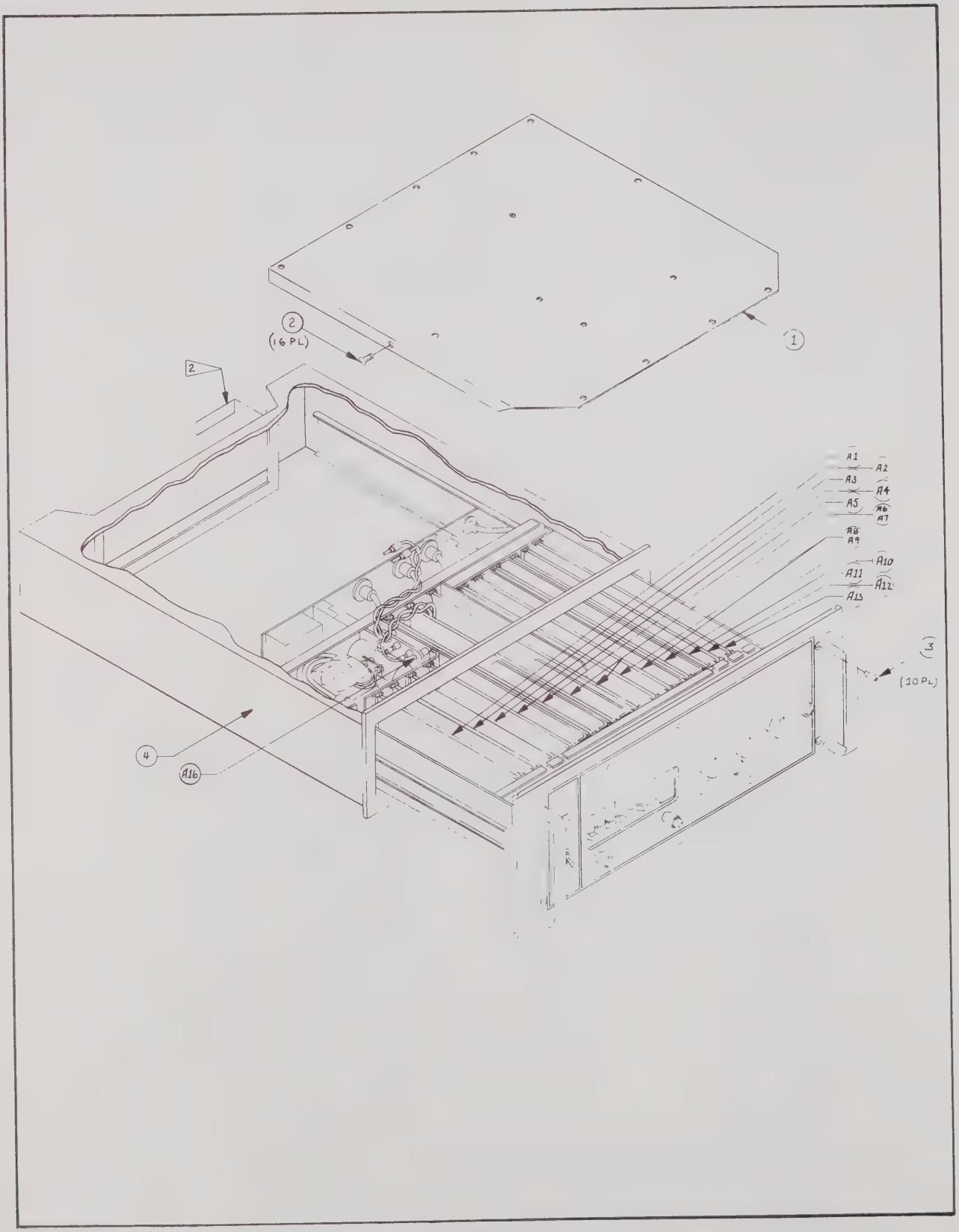


Figure 13 (1 of 6) DIGITAL MULTIMETER

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
6	Bushing, plstc	303388	89536	303388	8		
7	Bushing, plstc	305276	89536	305276	8		
8	Nut, self locking	329722	13257	LH3858-62	16		
9	Guard, Front Panel	332734	89536	332734	1		
10	Window Assy	329367	89536	329367	1		
11	Cover Access	314179	89536	314179	1		
12	Screw, PH, 4 40 x 5/16	335141	89536	335141	26		
13	Decal, Serial Number	194138	89536	194138	1		
14	Slide Chassis, MOD	314146	89536	314146	1 pr		
15	Cover, Cable	346395	89536	346395	2		
16	Chassis Assembly	329359	89536	329359	1		
17	Screw, fillister Hd	260646	95987	N-632-3/8	6		
18	Screw, truss Hd, 6 - 32 x 5/16	335174	89536	335174	8		
19	Insulator terminal strip	297846	89536	297846	2		
20	Terminal single	301390	89536	301390	3		
21	Solder lug	104091	79963	141	1		
22	Nut, self locking	329730	13257	LH3858-40	2		
23	Screw, PH, SS	376822	89536	376822	4		
24	Washer, lock, int	110338	89536	110338	4		
25	Clamp, cable	104406	89536	104406	1		
	See Figure 13 (Sheet 3 of 6) for the locations of the following parts						
26	Slide mount insl	338517	89536	338517	1		
27	Slide mount insl	314120	89536	314120	5		
28	Nut, self lock	329722	13257	LH3858-62	12		
29	Screw cap 8-32	295105	74445	8-32UNRCCL3A	6		
30	Washer, lock No. 8	110320	89536	110320	6		
31	Gasket	413906	89536	413906	1		

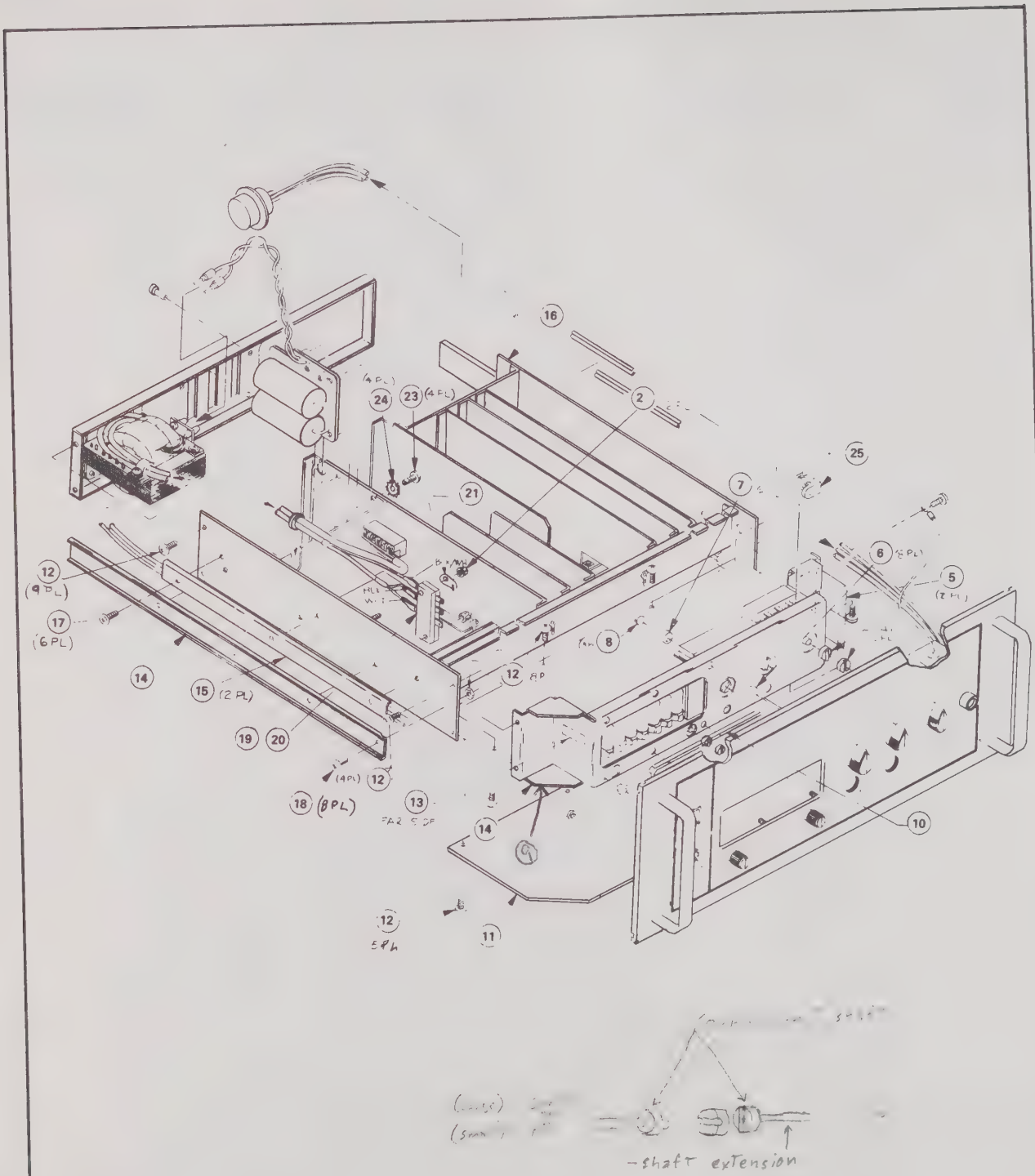


Figure 13 (2 of 6) DIGITAL MULTIMETER

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	See Figure 13 (Sheet 4 of 6) for the locations of the following parts:						
F1, F2	Fuse, fast acting	329854	75915	361015	2		
32	Cap Assy, fuse holder	339507	89536	339507	2		
33	Handle	331223	89536	331223	2		
34	Screw, 10/32 x 5/8 FHP	423236	89536	423236	4		
35	Receptacle, cap	327874	02660	348-140-10001	1		
36	Sleeving, plstc	113977	91094	Type 703/105	AR		
37	Holder, cap, small	337105	89536	337105	1		
38	Input filter Assy	391086	89536	391086	1		
39	Knob, skirt, pointed	329862	49956	70-5-2G	3		
40	Seal, hex	175984	97539	N-9030-1/4	3		
41	Shaft-extension	329342	89536	329342	3		
42	Bushing, panel	330373	73734	12600NP	3		
43	Washer, flat	110718	81349	AN960-4166	6		
44	Washer, spring tension	163170	71734	101-400	3		
45	Coupler unit, shaft	329896	zzzzz	A-201-5AS	3		
46	Knob, skirt,	329870	49956	50-2WD-1G	2		
47	Seal, hex, shaft	334631	97539	N-9040-1/8	2		
48	Shaft, extension	332759	89536	332759	2		
49	Bushing, panel	334649	71734	45-260NP	2		
50	Washer, flat	176743	86928	5710-31-32	4		
51	Washer, spring tension	334045	86928	5804-102-1	2		
52	Spacer, shaft coupler	356212	89536	356212	2		
53	Shaft coupler, special	352179	89536	352179	2		
54	Indicator Assy, illuminated	330977	08719	10629B x 10-1	1		
55	Lamp, in can (not shown)	277152	71744	CM387	2		
56	Gasket	330993	12881	02-0101-4366-01	1		
57	Circuit Breaker, Special	334664	07355	AP-12-1664-2	1		

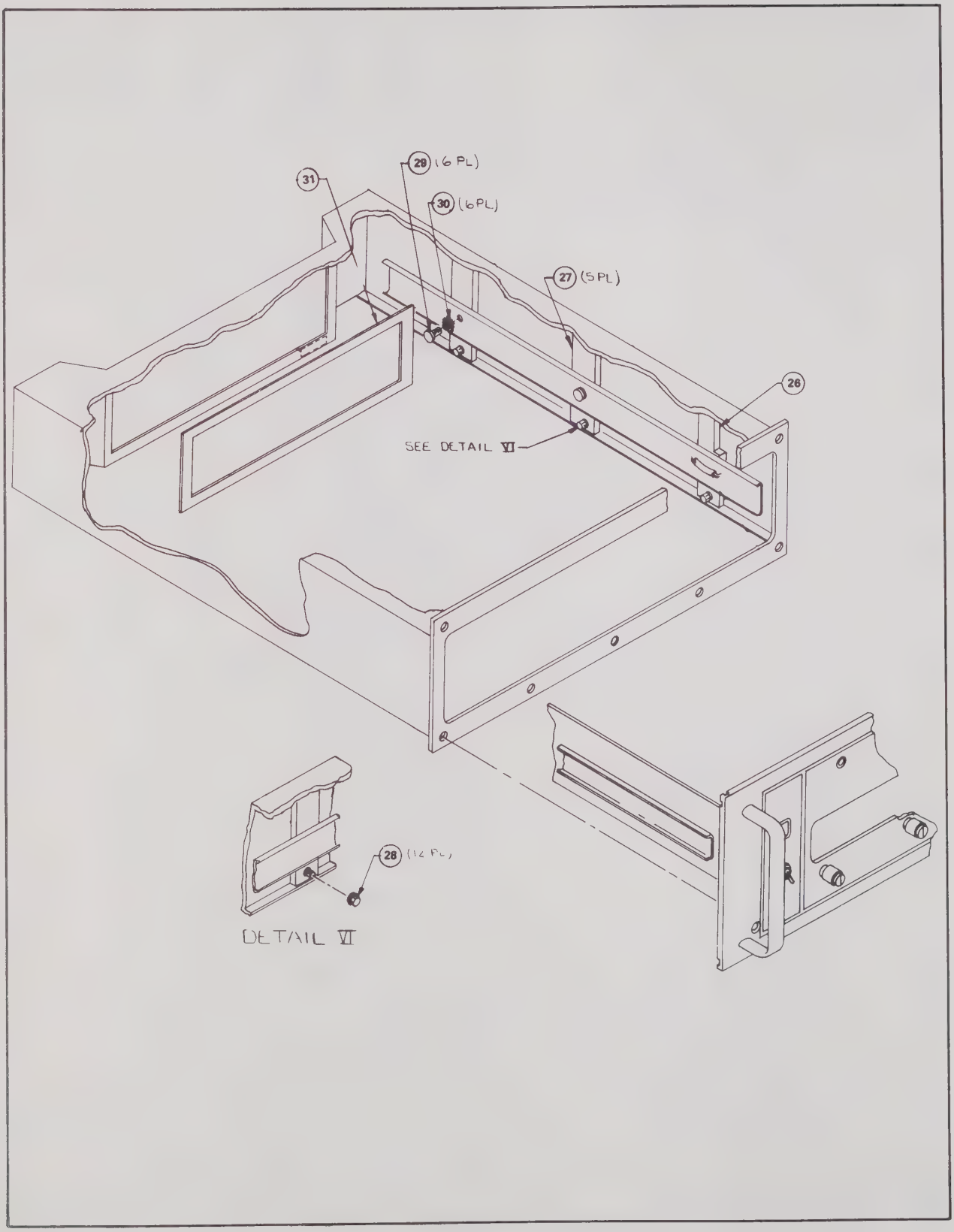


Figure 13 (3 of 6) DIGITAL MULTIMETER

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	See Figure 13 (Sheet 5 of 6) for the locations of the following parts:						
58	Spacer, right half	412080	89536	412080	2		
59	Spacer, left half	406769	89536	406769	2		
60	Screw, PH, 10 - 32 x ½	417261	89536	417261	4		
61	Screw, PH, 10 - 32 x 5/8	417279	89536	417279	4		
62	Nut, Hex 10 - 32	110536	89536	110536	4		
63	Screw, PH, 10 - 32 x 5/8	408666	89536	408666	4		
64	Cable, DOUI	391136	89536	391136	1		
65	Cable, DOUII	388538	89536	388538	1		
66	Cable, RCU	391128	89536	391128	1		
67	Screw, PH, 4 - 40 x ½	256172	89536	256172	6		
68	Washer	408674	89536	408674	6		
69	Cable tie	172080	06383	SST-1M	5		
70	AC Filter Assy	391078	89536	391078	1		
Q1	Xstr, Pwr, Si NPN	334003	01295	2N3055	1		
71	Insulator, mica, xstr	101493	08530	757	1		
72	Screw, PHP, 6 - 32 x ½	320051	89536	320051	2		
73	Bracket, xstr	391110	89536	391110	1		
74	Spring, ground	412767	89536	412767	1		
75	Screw, FH, SS 4 - 40 x ¼	320077	89536	320077	2		
76	Nut, Hex, self lock	329730	13257	LH3858-40	3		
77	Cable, tie anchor	104406	06383	TA1S8	1		
78	Socket, xstr	342816	91506	X8080-1G10	1		
79	Screw, FH, 4 - 40 x ½	149047	89536	149047	1		
80	Case, rear panel	412049	89536	412049	1		
T1	Xfmr, power	333617	89536	333617	1		
81	Screw, cap, 8 - 32 x 3/8	295105	89536	295105	2		
82	Washer, lock int	110320	89536	110320	2		
83	Mounting, xfmr	314187	89536	314187	1		

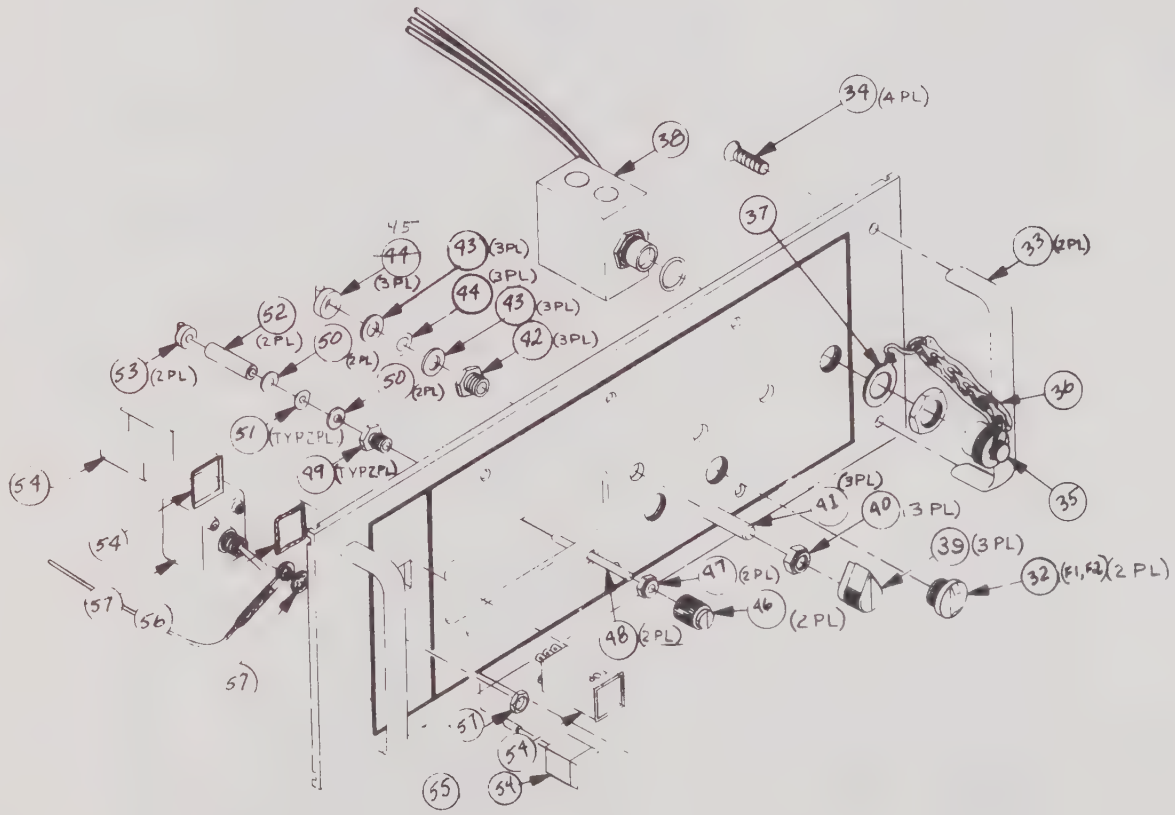


Figure 13 (4 of 6) DIGITAL MULTIMETER

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	See Figure 13 (Sheet 6 of 6) for the location of the following parts						
84	Screw, Truss head, 6 - 32 x 5/16	335174		AN526C-R	4		
85	Screw, PH, 8 - 32 x 3/4	335109	89536	335109	4		
86	Washer, flat, SS	176743	86928	5710-31-32	4		
87	Bushing, chassis, mtg	303388	89536	303388	4		
88	Bushing, plstc	305276	89536	305276	4		
~~80~~89	Rear guard, panel	391060	89536	391060	1		

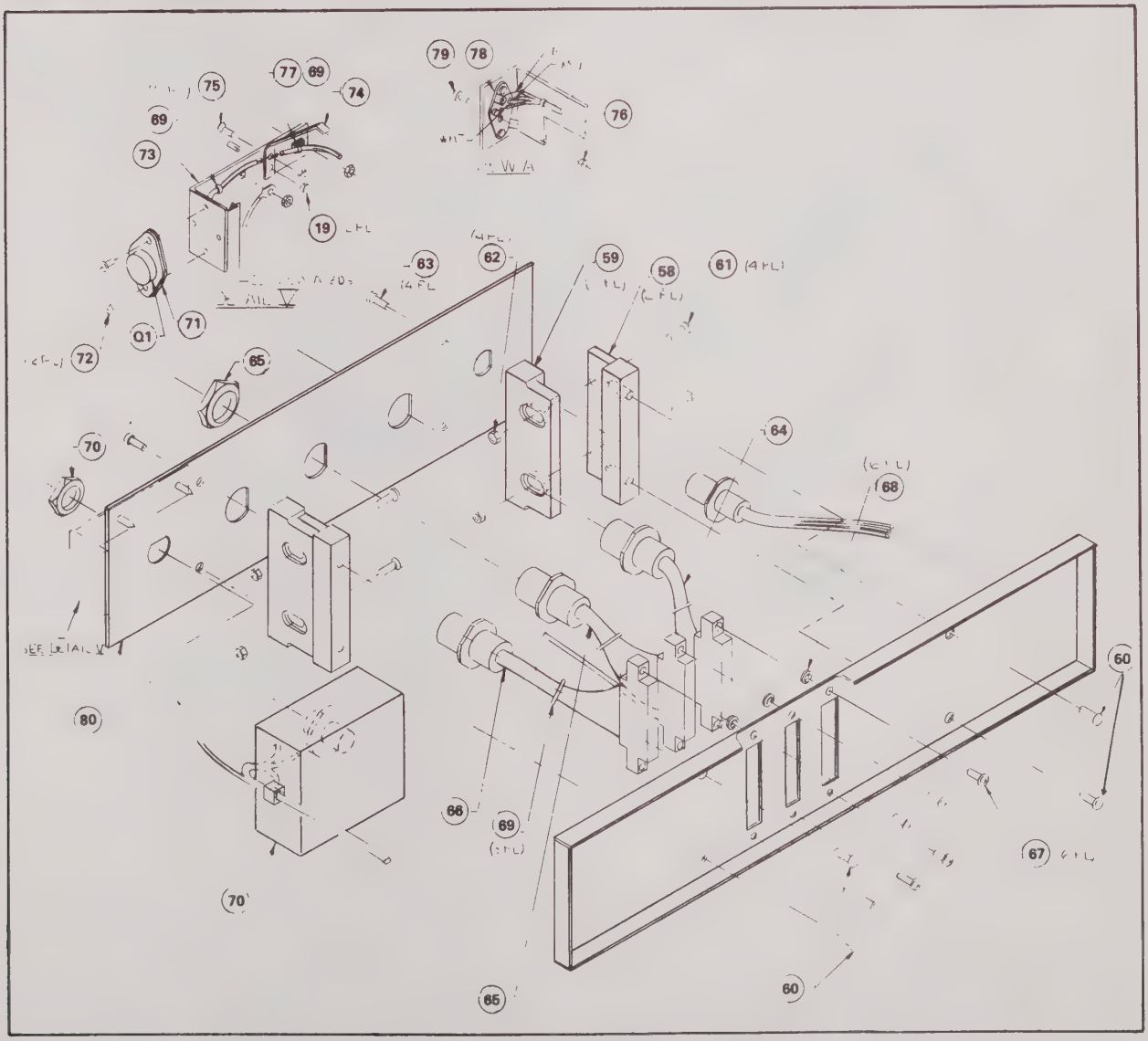


Figure 13 (5 of 6) DIGITAL MULTIMETER

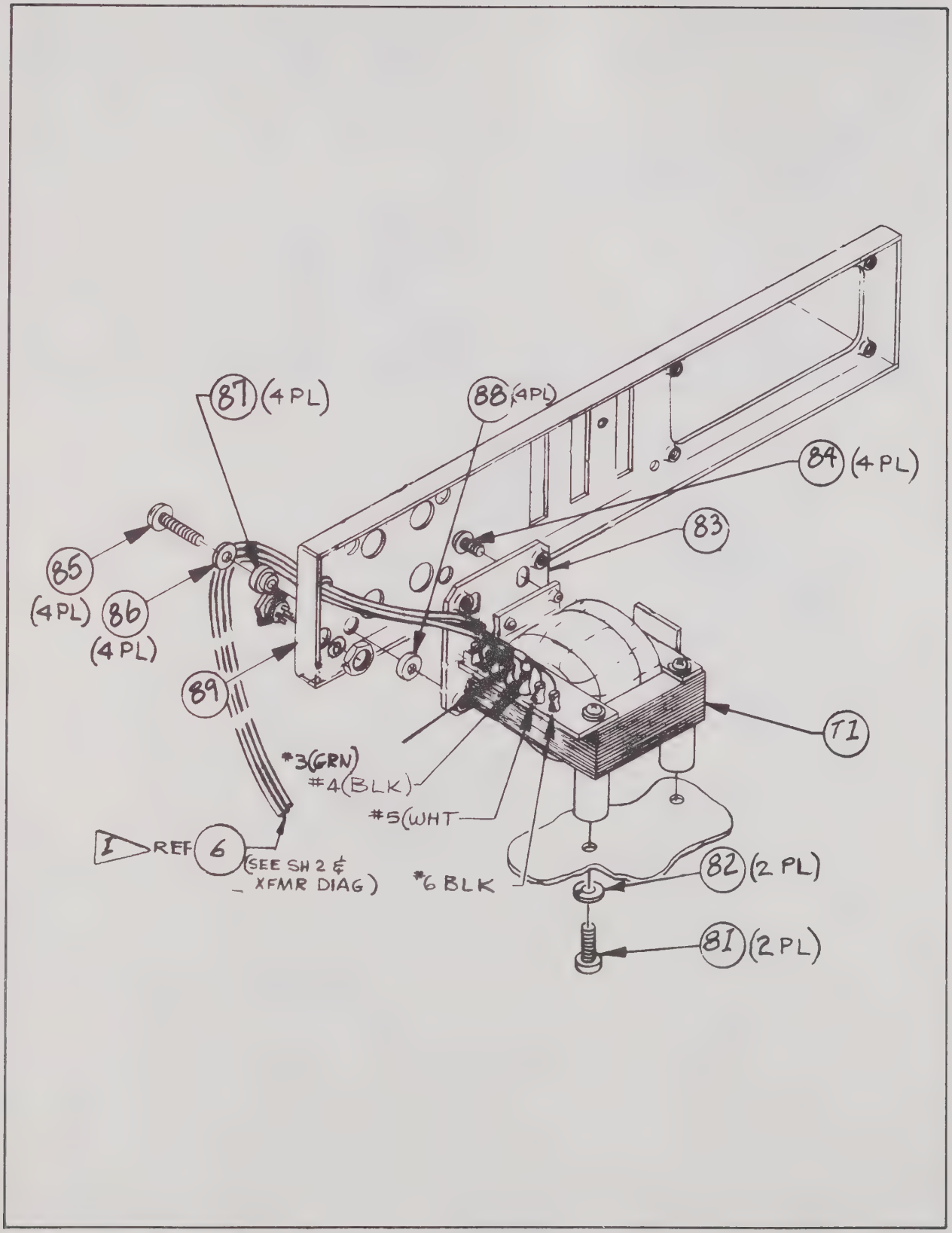


Figure 13 (6 of 6) DIGITAL MULTIMETER

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A1	**POWER SUPPLY PCB** **Figure 14**		REF		
C1	Cap, elect, 8 uf +50/-10%, 350V	275792	1		
C2, C5	Cap, elect, 250 uf +50/-10%, 40V	178616	2		
C3, C7	Cap, mica, 33 pf ±5%, 500V	160317	2		
C4, C6	Cap, elect, 50 uf +50/-10%, 25V	168823	2		
C8	Cap, elect, 7100 uf +75/-10%, 10V	295196	1		
CR1 thru CR4	Diode, rectifier, silicon, 1 amp, 1000V, piv	329680	4		
CR5 thru CR8, CR10 thru CR13	Diode, rectifier, silicon, 1 amp, 1000V, piv	329672	8		
CR9	Diode, zener, 12V	249052	1		
Q1, Q2	Tstr, silicon, NPN	218511	2		
Q3, Q8	Tstr, silicon, NPN	150359	2		
Q4	Not used				
Q5	Tstr, silicon, PNP	269076	1		
Q6	Tstr, silicon, NPN	334003	1		
Q7	Tstr, silicon, NPN	328435	1		
R1	Res, comp, 510Ω ±5%, 1/2w	108951	1		
R2	Res, comp, 68k ±5%, 1/4w	148171	1		
R3	Res, met flm, 383k ±1%, 1/8w	288498	1		
R4, R15	Res, met flm, 40.2k ±1%, 1/8w	235333	2		
R5, R8	Res, comp, 51Ω ±5%, 1/2w	144717	2		
R6	Res, ww, 7.2k ±0.1%, 1/4w	295121	1		
R7	Not used				
R9	Res, ww, 4.02k ±1%, 1/4w	240937	1		
R10, R12	Res, met flm, 10k ±1%, 1/8w	168260	2		
R11	Res, var, cermet, 500Ω ±10%, 1/2w	291120	1		
R13, R16	Res, comp, 5.6k ±5%, 1/4w	148080	2		
R14	Res, met flm, 9.53k ±1%, 1/8w	288563	1		
R17	Res, comp, 220k ±5%, 1/4w	160937	1		
U1, U2	IC, Operational amplifier	271502	2		
	Heat sink	336180	1		

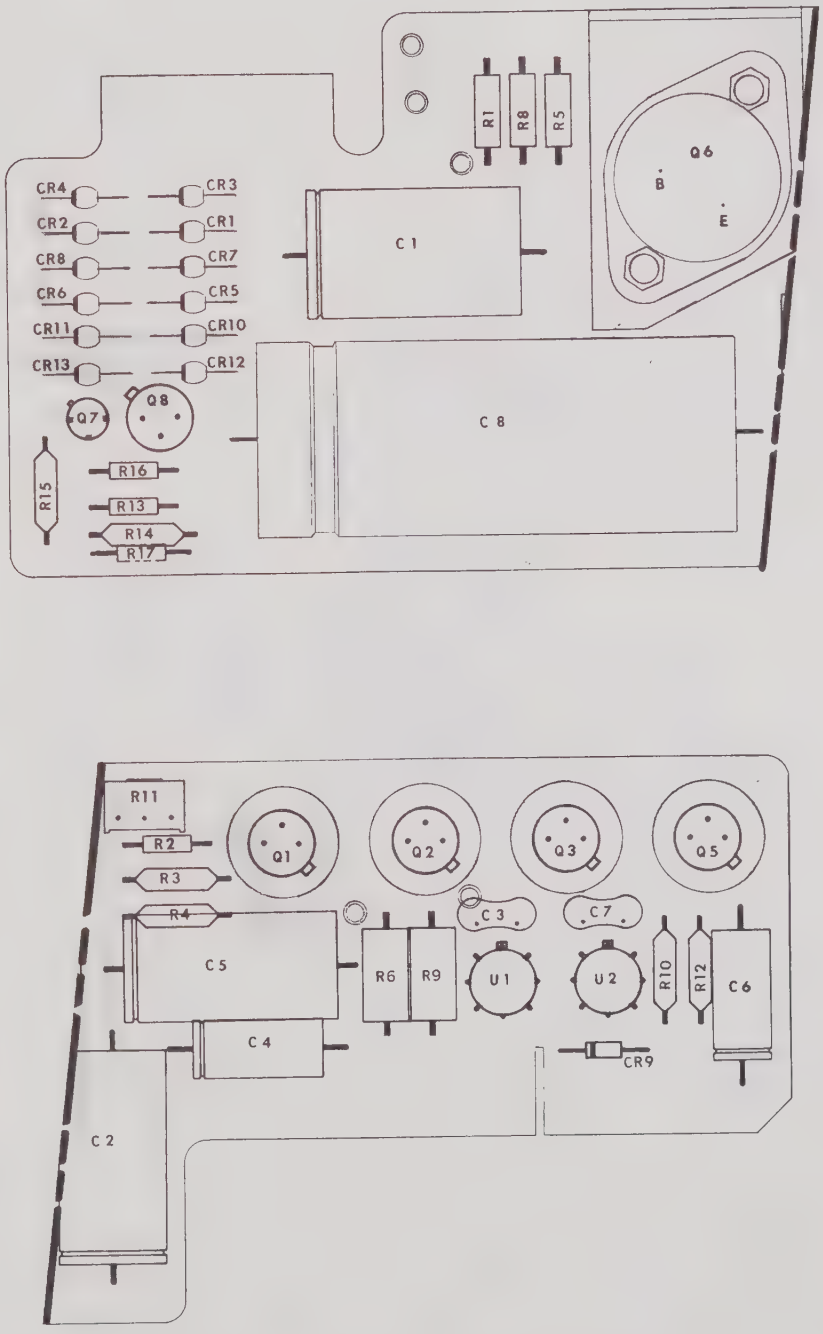


Figure 14. POWER SUPPLY PCB.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A2	**RANGE DELAY** **Figure 15**		REF		
C1, C3	Cap, cer, 0.025 uf ±20%, 50V	168435	2		
C2, C6	Cap, Ta, 3.3 uf ±5%, 20V	271320	2		
C4	Cap, plstc, 0.01 uf ±2%, 100V	168385	1		
C5	Cap, elect, 200 uf +50/-10%, 10V	236935	1		
CR1, CR3, CR4, CR9, CR11, CR13 thru CR17	Diode, silicon, 150 mA	203323	11		
CR2, CR6, CR7, CR8, CR10, CR12	Diode, germanium, 80 mA, 100 piv	149187	6		
Q1, Q2	Tstr, silicon, NPN	168708	2		
Q3, Q5	Tstr, silicon, NPN	328435	2		
Q4	Tstr, silicon, unijunction, programmable	327718	1		
R1, R6, R15	Res, comp, 220Ω ±5%, 1/4w	147959	3		
R2	Res, comp, 22k ±5%, 1/4w	148130	1		
R3, R7	Res, comp, 4.7k ±5%, 1/4w	148072	2		
R4, R17	Res, comp, 27k ±5%, 1/4w	148148	2		
R5	Res, comp, 51k ±5%, 1/4w	193334	1		
R8	Res, met flm, 27.4k ±1%, 1/8w	241471	1		
R9	Res, met flm, 15.4k ±1%, 1/8w	261651	1		
R10	Res, comp, 47k ±5%, 1/4w	148163	1		
R11, R19	Res, comp, 10k ±5%, 1/4w	148106	1		
R12	Res, met flm, 10k ±1%, 1/8w	168260	1		
R13	Res, met flm, 36.5k ±1%, 1/8w	235309	1		
R14	Res, met flm, 16.9k ±1%, 1/8w	267146	1		
R16	Res, comp, 5.1k ±5%, 1/4w	193342	1		
R18	Res, var, cermet, 10k ±10%, 1/2w	285171			
U1	IC, Hex inverter	327700	1		
U2	IC, DTL, Triple, 3-input, Nand Gate	327742	1		
U3	IC, DTL, Dual, 4-input Nand Gate	327692	1		
	IC, socket, dual in-line, 14 contact	276527	3		

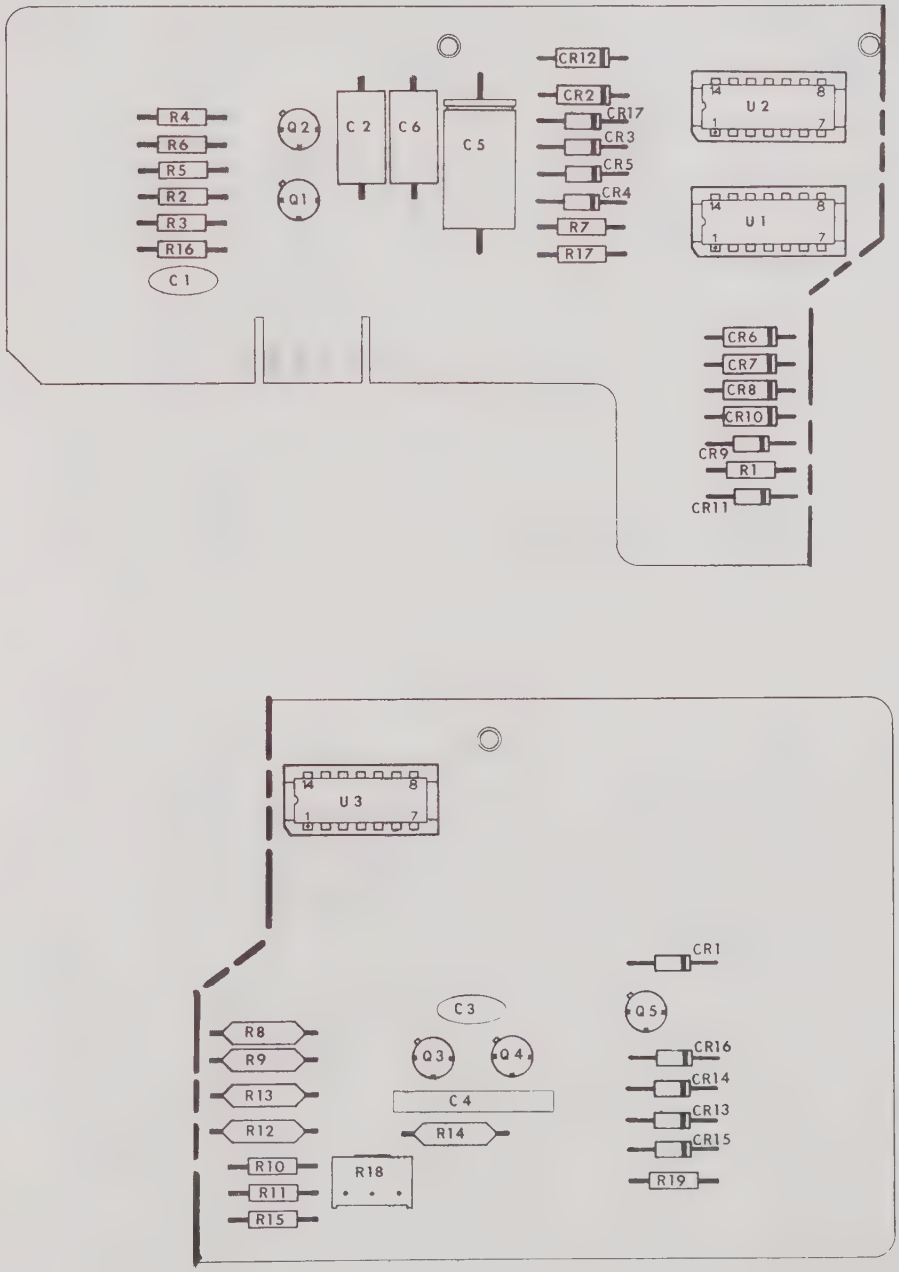


Figure 15. RANGE DELAY.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A3	**DC EXTERNAL REFERENCE ASSEMBLY** Figure 16		REF		
C1	Cap, plstc, 0.1 uf ±10%, 120V	167460	1		
C2	Cap, plstc, 0.47 uf ±20%, 120V	190553	1		
C3	Cap, mica, 100 pf ±5%, 500V	148494	1		
C4	Cap, mica, 47 pf ±5%, 500V	148536	1		
C5, C7, C8	Cap, mica, 220 pf ±5%, 500V	170423	3		
C6	Cap, plstc, 0.047 uf ±10%, 120V	260562	1		
C9	Cap, mica, 33 pf ±5%, 500V	160317	1		
CR1, CR2, CR4, CR6 thru CR9	Diode, silicon, 150 mA, 125 piv	272252	7		
CR3	Diode, germanium, fast switching	180505	1		
CR5	Diode, zener, 12V	159780	1		
CR10, CR13	Diode, germanium, 80 mA, 100 piv	149187	2		
CR11, CR12	Diode, silicon, 150 mA	203323	2		
K1	Switch, reed relay	219097	1		
K1	Coil, reed relay	269019	1		
Q1, Q6, Q10	Tstr, silicon, PNP	328427	3		
Q2, Q3, Q7	Tstr, silicon, NPN	328435	3		
Q4, Q5	Tstr, FET, N-channel	328245	2		
Q8	Tstr, silicon, NPN, Super-beta, dual monolithic	284075	1		
Q9	Tstr, FET, Dual, P-channel	268011	1		
R1	Res, comp, 4.7k ±5%, 1/4w	148072	1		
R2	Res, comp, 33k ±5%, 1/4w	148155	1		
R3, R5	Res, ref divider set	278309	1		
R4, R20	Res, var, cermet, 5k ±20%, 1/2w	267872	2		
R6	Not used				
R7, R8, R13	Res, comp, 22k ±5%, 1/4w	148130	3		
R9	Res, comp, 6.8k ±5%, 1/4w	148098	1		
R10, R28	Res, comp, 12k ±5%, 1/4w	159731	2		
R11	Res, comp, 120k ±5%, 1/4w	193458	1		

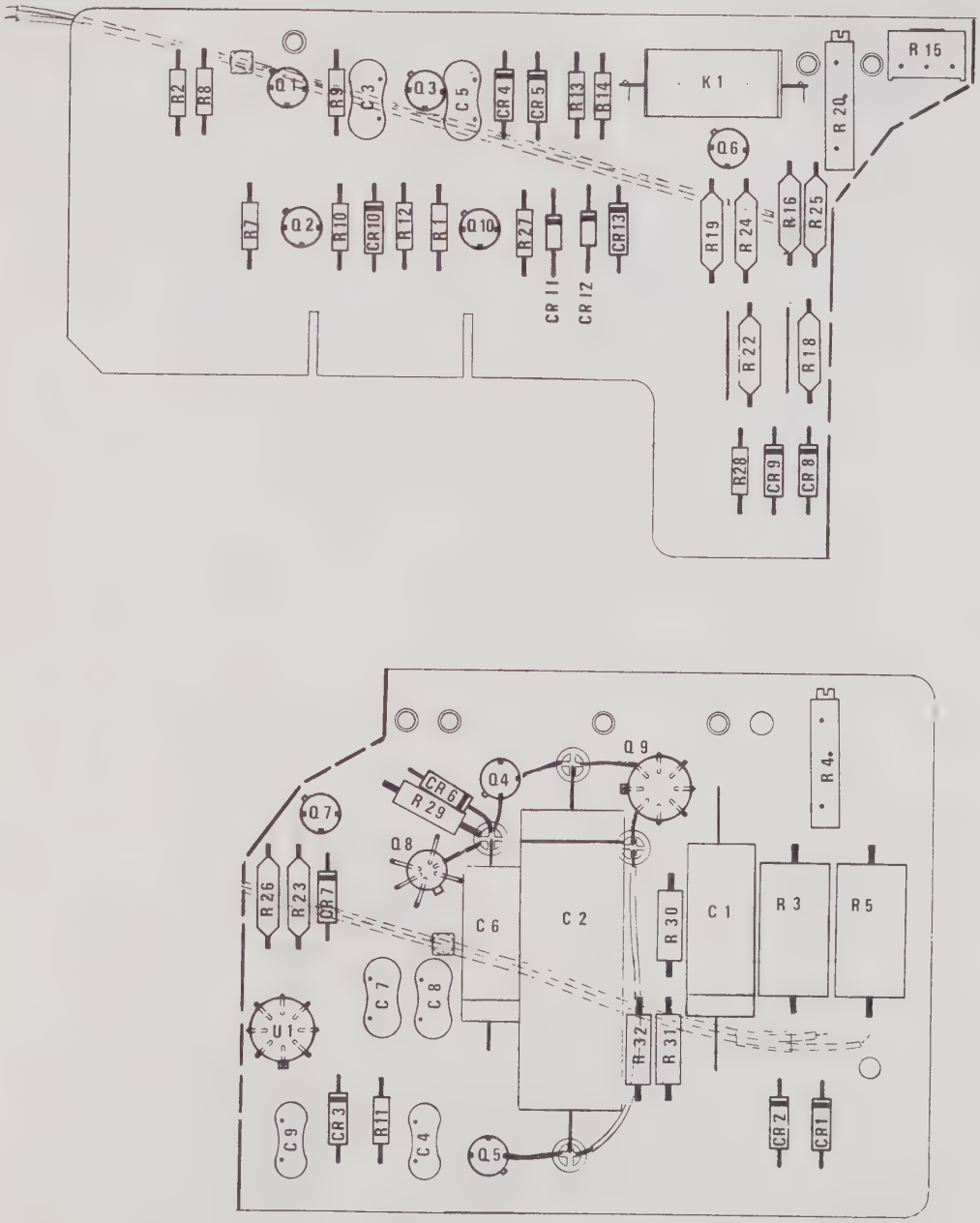


Figure 16. DC EXTERNAL REFERENCE ASSEMBLY.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R12	Res, comp, 2.2M, ±5%, 1/4w	198390	1		
R14	Res, comp, 180k ±5%, 1/4w	193441	1		
R15	Res, var, cermet, 1k ±10%, 1/2w	285155	1		
R16	Res, met flm, 1.54k ±1%, 1/8w	289066	1		
R17	Not used				
R18, R22	Res, met flm, 215k ±1%, 1/8w	289470	2		
R19	Res, met flm, 2k ±1%, 1/8w	235226	1		
R21	Not used				
R23	Res, met flm, 140k ±1%, 1/8w	289439	1		
R24	Res, met flm, 7.15k ±1%, 1/8w	260356	1		
R25	Res, met flm, 82.5k ±1%, 1/8w	246223	1		
R26	Res, met flm, 8.66k ±1%, 1/8w	260364	1		
R27	Res, comp, 1k ±5%, 1/4w	148023	1		
R29, R30, R32	Res, comp, 100M ±10%, 1/2w	190520	3		
R31	Res, comp, 4.7M ±10%, 1/2w	108308	1		
U1	IC, Operational amplifier	271502	1		

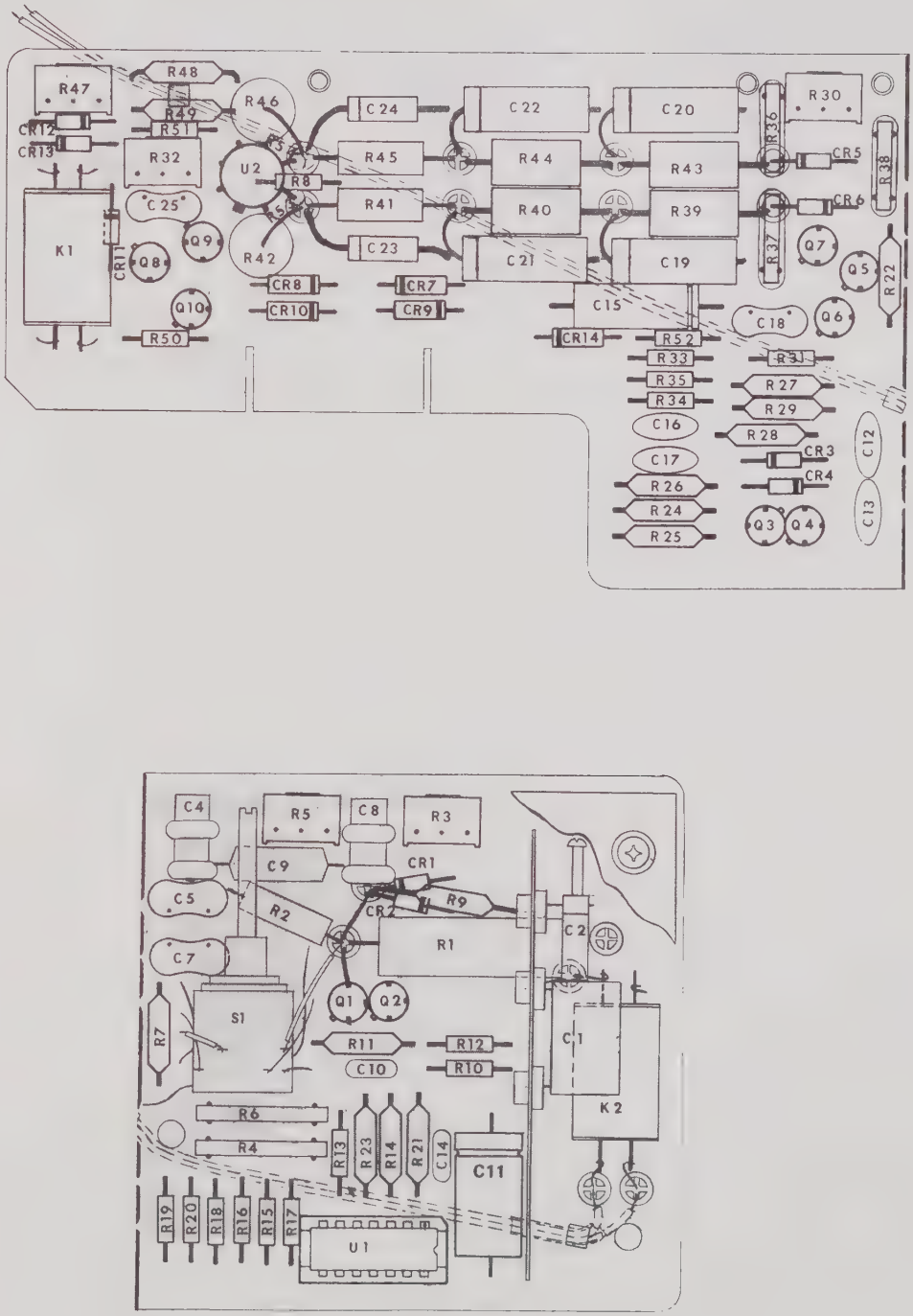


Figure 17. AC EXTERNAL REFERENCE ASSEMBLY.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A4	**AC EXTERNAL REFERENCE ASSEMBLY** **Figure 17**		REF		
C1	Cap, plstc, 0.22 uf ±10%, 250V	194803	1		
C2	Cap, var, teflon, 0.25 to 1.5 pf, 2kV	273151	1		
C3, C4	Cap, var, air, 0.8 to 10 pf, 250V	229930	2		
C5	Cap, mica, 12 pf ±5%, 500V	175224	1		
C6	Not used				
C7	Cap, mica, 220 pf ±5%, 500V	170423	1		
C8	Not used				
C9	Cap, cer, 3 pf ±10%, 500V	226316	1		
C10, C14	Cap, Ta, 4.7 uf ±20%, 20V	161943	2		
C11	Cap, elect, 125 uf +50/-10%, 16V	186296	1		
C12, C13	Cap, cer, 500 pf ±10%, 500V	105692	2		
C15	Cap, elect, 50 uf +50/-10%, 25V	168823	1		
C16, C17	Cap, cer, 0.01 uf ±20%, 100V	149153	2		
C18	Cap, mica, 27 pf ±5%, 500V	177998	1		
C19 and C20, C21 and C22	Cap, plstc, 1 uf, matched set	288225	2		
C23, C24	Cap, plstc, 0.033 uf, matched pair	290155	1		
C25	Cap, mica, 33 pf ±5%, 500V	160317	1		
CR1 thru CR6	Diode, silicon, semicon, 100 mA, 1.5V	348177	6		
CR7 thru CR10, CR14	Diode, germanium, 80 mA, 100 piv	149187	5		
CR11, CR12, CR13	Diode, silicon, 150 mA	203323	3		
K1 K1	Switch, reed relay Coil, reed relay	219097 272070	1 2		
K2 K2	Switch, reed relay Coil, reed relay	284091 270207	1 REF		
Q1	Tstr, FET, N-channel	327726	1		
Q2, Q6 Q9, Q10	Tstr, silicon, NPN	329698	4		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
Q3, Q4 Q5, Q7	Tstr, silicon, PNP	331017	4		
Q8	Tstr, silicon, PNP	331025	1		
R1, R2	Res, met flm, 1.11M and 267k, matched set	269092	1		
R3	Res, var, cermet, 2k ±10%, 1w	285163	1		
R4	Res, ww, 29.53k ±0.1%, 1/2w	277657	1		
R5	Res, var, cermet, 200Ω ±10%, 1w	285148	1		
R6	Res, ww, 2.573k ±0.1%, 1/2w	277665	1		
R7	Res, met flm, 10Ω ±1%, 1/8w	268789	1		
R8	Res, comp, 620Ω ±5%, 1/4w	221903	1		
R9	Res, met flm, 49.9k ±1%, 1/8w	268821	1		
R10	Res, comp, 8.2k ±5%, 1/4w	160796	1		
R11, R26	Res, met flm, 590Ω ±1%, 1/8w	261883	2		
R12, R33, R52	Res, comp, 10k ±5%, 1/4w	148106	3		
R13	Res, comp, 15k ±5%, 1/4w	148114	1		
R14	Res, met flm, 84.5k ±0.5%, 1/8w	229492	1		
R15, R18 R53, R54	Res, comp, 120k ±5%, 1/4w	193458	4		
R16, R17	Res, comp, 11k ±5%, 1/4w	221580	2		
R19, R20	Res, comp, 47Ω ±5%, 1/4w	147892	2		
R21, R22	Res, met flm, 40.2k ±1%, 1/8w	235333	2		
R23	Res, met flm, 82.5k ±1%, 1/8w	246223	1		
R24, R28	Res, met flm, 10k ±1%, 1/8w	168260	2		
R25, R27	Res, met flm, 21.5k ±1%, 1/8w	168278	2		
R29	Res, met flm, 1.21k ±1%, 1/8w	229146	1		
R30, R32	Res, var, cermet, 100k ±10%, 1w	288308	2		
R31	Res, comp, 10M ±5%, 1/4w	194944	1		
R34	Res, comp, 22k ±5%, 1/4w	148130	1		
R35	Res, comp, 2.2k ±5%, 1/4w	148049	1		
R36, R37	Res, ww, 1.196k ±0.1%, 1/4w	299610	2		
R38	Res, ww, 125Ω ±0.1%, 1/4w	249284	1		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R39, R40 R43, R44	Res, ww, 130k ±0.1%, 1/4w	285361	4		
R41, R45	Res, ww, 40k ±0.1%	271403	2		
R42, R46	Res, ww, 1M ±0.1%	271411	2		
R47	Res, var, cermet, 10k ±10%, 1/2w	285171	1		
R48	Res, met flm, 100Ω ±1%, 1/8w	168195	1		
R49	Res, met flm, 487k ±1%, 1/8w	237206	1		
R50	Res, comp, 430Ω ±5%, 1/4w	203869	1		
R51	Res, comp, 6.2k ±5%, 1/4w	221911	1		
S1	Switch, rotary	295535	1		
U1	IC, Linear, 5-Tstr array, 16 pin	327668	1		
U2	IC, Operational amplifier	288928	1		
	Socket, IC, dual-in line	387316	1		

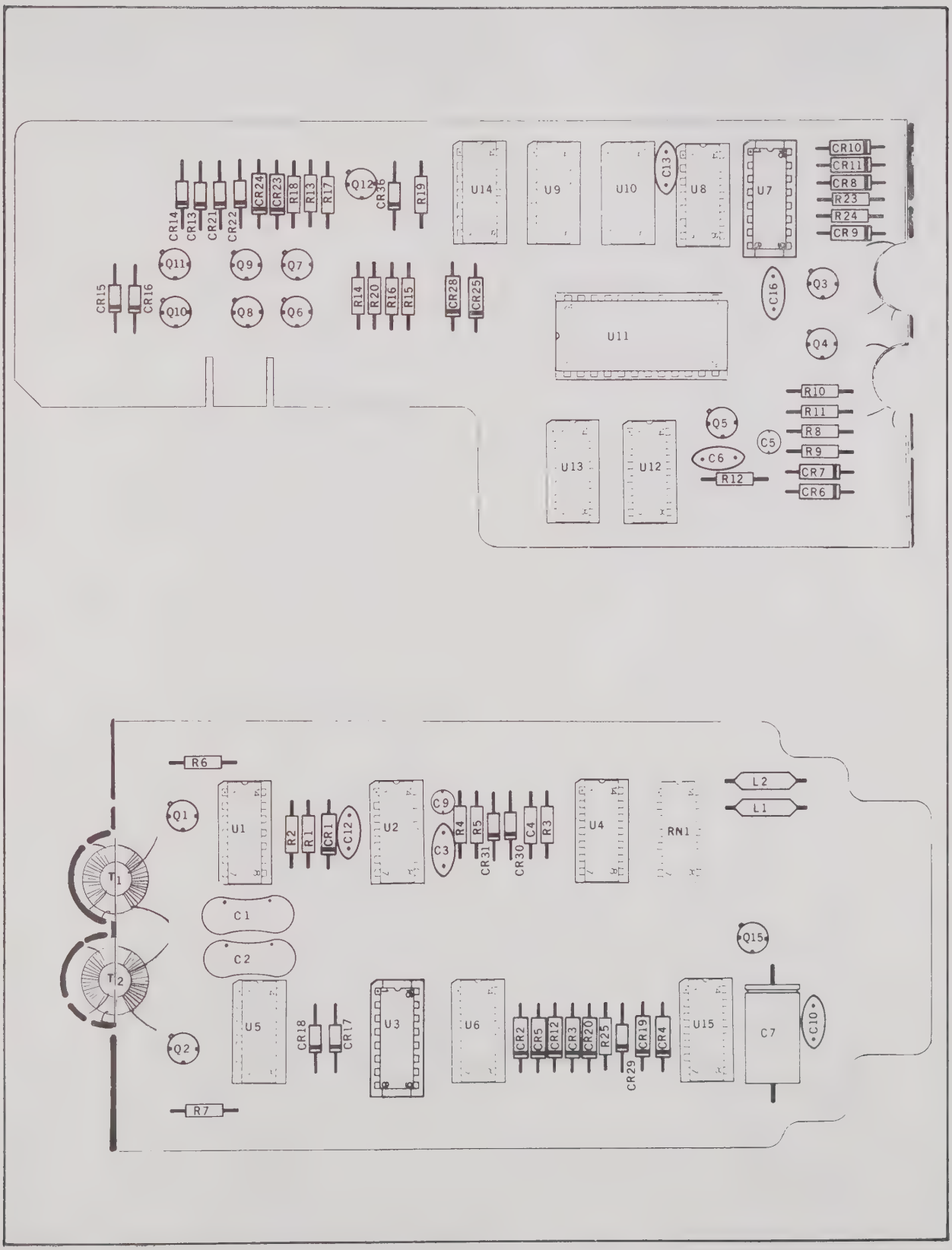


Figure 18. REMOTE CONTROL UNIT ASSEMBLY.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A5	**REMOTE CONTROL UNIT ASSEMBLY** Figure 18		REF		
C1, C2	Cap, mica, 1500 pf ±5%, 500V	148361	2		
C3	Cap, cer, 0.01 uf ±20 %, 100V	149153	1		
C4	Cap, Ta, 68 uf ±10%, 15V	160242	1		
C5	Cap, Ta, 1 uf ±20%, 35V	161919	1		
C6, C12	Cap, cer, 0.0012 uf ±10/, 500V	106732	2		
C7	Cap, elect, 200 uf +50/-10%, 10V	236935	1		
C8	Cap, cer, 0.01 uf ±20%, 500V	105668	1		
C9	Cap, Ta, 39 uf +80/-20%, 20V	163915	1		
C10	Cap, cer, 0.025 uf ±20%, 50V	168435	1		
C13, C16	Cap, cer, 0.005 uf ±20%, 50V	175232	2		
CR1 thru CR12, CR19, CR20, CR23, CR24, CR25, CR28	Diode, germanium, 80 mA, 100 piv	149187	18		
CR13 thru CR18, CR21 CR22, CR29, CR30, CR31, & CR36	Diode, silicon, 150 mA	203323	12		
Q1, Q2 Q12, Q15	Tstr, silicon, NPN	328435	4		
Q3, Q4, Q5 Q8, Q9	Tstr, silicon, PNP	328427	5		
Q6, Q7, Q10, Q11	Tstr, silicon, PNP	331025	4		
R1, R2	Res, comp, 820Ω ±5%, 1/4w	148015	2		
R3	Res, comp, 47Ω ±5%, 1/4w	147892	1		
R4, R5	Res, comp, 1k ±5%, 1/4w	148023	2		
R6, R7	Res, comp, 100Ω ±5%, 1/4w	147926	2		
R8, R9	Res, comp, 330Ω ±5%, 1/4w	147967	2		
R10, R19	Res, comp, 3.3k ±5%, 1/4w	148056	2		
R11	Res, comp, 2.2k ±5%, 1/4w	148049	1		
R12, R25	Res, comp, 10k ±5%, 1/4w	148106	2		
R13, R18, R20	Res, comp, 270Ω ±5%, 1/4w	160804	3		
R14 thru R17	Res, comp, 390Ω ±5%, 1/4w	147975	4		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R22	Not used				
R23, R24	Res, comp, 1.2k ±5%, 1/4w	190371	2		
RN1	Res, Network, 4.7k ±5%, ¼W	387100	1		
T1, T2	Transformer, pulse	275362	2		
U1	IC, TTL, Quad, 2-Input Nor	327684	1		
U2	IC, DTL, Binary counter, divide by 16	327650	1		
U3	IC, TTL, Digital, Multiplexer	327619	1		
U4	IC, TTL, Quad, 2-Input Nand Gate	327676	1		
U6, U12 U13, U14	IC, DTL, Quad, 2-Input Nand Gate	327643	4		
U5	IC, DTL, Dual 4-Input Nand Gate	327692	1		
U7	IC, TTL, Dual J-K Flip-Flop, 16 pin	268441	1		
U8, U9, U10	IC, DTL, Dual J-K Flip-Flop, 14 pin	327767	3		
U11	IC, TTL, 8 Bit latch, bistable	327783	1		
U15	IC, DTL, Hex Inverter	327700	1		
	Socket, IC, dual-in line	276527	12		
	Socket, IC, dual-in line	276535	2		
	Socket, IC, 24 pin	292946	1		
L1, L2	Choke, 47 uH	147850	2		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A6	**DATA OUTPUT UNIT No. 2** **Figure 19**		REF		
C1 thru C5	Not used				
C6, C12, C24 C25, C43, C49	Cap, cer, 0.0012 uf ±10%, 500V	106732	6		
C7	Not used				
C8	Cap, plst, 0.22 uf ±10%, 250V	194803	1		
C9	Cap, Ta, 3.3 uf ±5%, 20V	271320	1		
C10, C41, C46, C47, C50, C51,	Cap, cer, 0.01 uf ±20%, 100V	149153	6		
C11	Cap, Ta, 4.7 uf ±10%, 15V	106898	1		
C13	Cap, cer, 0.005 uf ±20%, 50V	175232	1		
C14	Cap, Ta, 0.33 uf ±5%, 20V	271338	1		
C15	Cap, Ta, 0.68 uf ±10%, 35V	182790	1		
C16 thru C19	Not used				
C20	Cap,mica, 430 pf ±5%, 500V	177980	1		
C23	Cap, cer, 0.025 uf ±20%, 50V	168435	1		
C26 thru C40	Not used				
C42, C53	Cap, cer, 0.002 uf ± GMV, 1kV	105569	2		
C44	Cap, plstc, 0.0047 uf ±20%, 200V	106054	1		
C45, C48	Cap, cer, 500 pf ±10%, 500V	105692	2		
C53	Not used				
C54	Cap, elect, 220 uf +50/−10%, 10V	236935	1		
CR1	Not used				
CR2, CR14, CR18, CR46 thru CR49, CR60, CR61, CR62, CR63, CR71, CR72	Diode, germanium, 80 mA, 100 piv	149187	13		
CR3, CR15, CR16, CR17, CR23 thru CR30, CR35	Diode, silicon, 150 mA	203323	17		

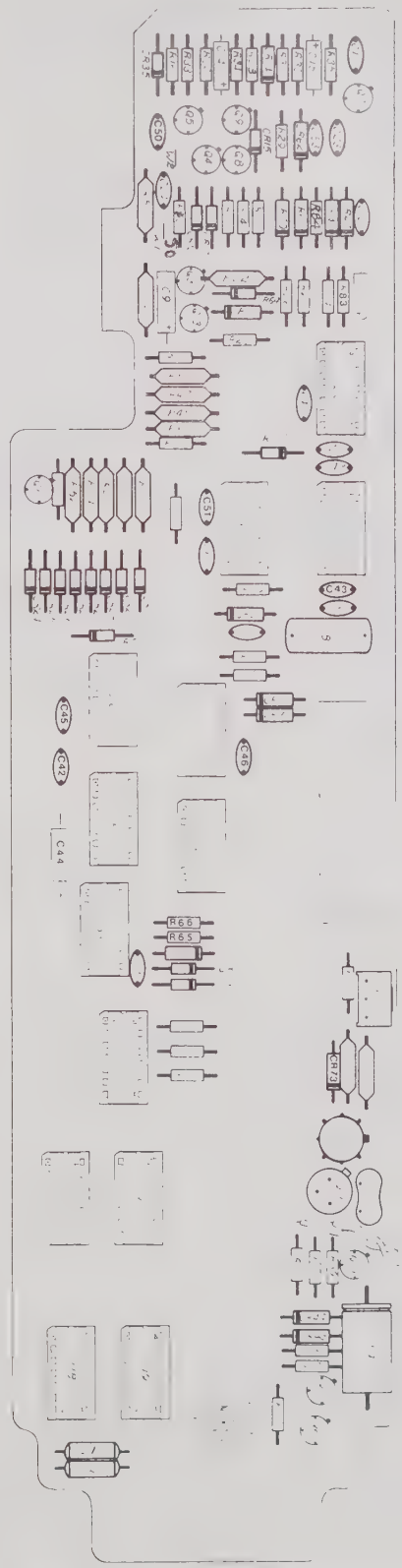


Figure 19. DATA OUTPUT UNIT NO. 2.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
CR64, CR69, CR70, CR100	Diode, silicon, 150 mA	203323			
CR4 thru CR13, CR19 thru CR22	Not used				
CR23	Diode, zener, 3.9V, 20 mA	113316	1		
CR31, CR33, CR34, CR36 thru CR41, CR50 thru CR56, CR58, CR59, CR65 thru CR68	Not used				
L1, L2	Choke, 47 uH	147850	2		
Q1, Q2, Q6, Q7, Q8, Q10	Tstr, silicon, NPN	328435	6		
Q3, Q9, Q13	Tstr, silicon, PNP	328427	3		
Q4	Tstr, silicon, NPN	329698	1		
Q5	Tstr, silicon, PNP	331017	1		
Q11	Tstr, silicon, PNP	269076	1		
Q12	Not used				
R1, R2, R3	Not used				
R4, R5, R30, R31, R62, R64, R67, R80, R81, R82	Res, comp, 4.7k ±5%, 1/4w	148072	10		
R6 thru R13	Not used				
R14, R15	Res, comp, 2.7k ±5%, 1/4w	170720	2		
R16	Res, comp, 47k ±5%, 1/4w	148163	1		
R17	Res, comp, 6.8k ±5%, 1/4w	148098	1		
R18, R59	Res, comp, 680Ω ±5%, 1/4w	148007	2		
R19, R20, R21, R25, R26, R27	Res, comp, 10k ±5%, 1/4w	148106	6		
R22,R69	Res, met flm, 6.34k ±1%, 1/8W	267344	2		
R23	Not used				
R24, R39 R61	Res, comp, 1k ±5%, 1/4w	148023	3		
R28	Res, comp, 220Ω ±5%, 1/4w	147959	1		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R29	Res, comp, 1.8k ±5%, 1/4w	175042	1		
R32	Res, comp, 2.2k ±5%, 1/4w	148049	1		
R33	Res, comp, 3.3k ±5%, 1/4w	148056	1		
R34	Res, comp, 27k ±5%, 1/4w	148148	1		
R35	Res, comp, 15k ±5%, 1/4w	148114	1		
R36	Res, comp, 4.3k ±5%, 1/4w	193375	1		
R37	Res, comp, 5.1k ±5%, 1/4w	193342	1		
R38	Res, var, cermet, 20k ±10%, 1/2w	291609	1		
R40, R41	Not used				
R42	Res, comp, 150k ±5%, 1/4w	182212	1		
R43, R44,	Not used				
R45, R47 R53, R56	Res, met flm, 105k ±1%, 1/8w	291294	4		
R46, R48, R54	Res, met flm, 20.5k ±1%, 1/8w	261669	3		
R49	Res, met flm, 274k ±1%, 1/8w	237297	1		
R50	Res, factory selected		1		
R51	Res, met flm, 140k ±0.5%, 1/8w	233148	1		
R52	Res, met flm, 6.81k ±1%, 1/8w	268417	1		
R55	Not used				
R57	Res, met flm, 5.49k ±1%, 1/8w	334565	1		
R58	Res, comp, 56k ±5%, 1/4w	170738	1		
R63	Res, comp, 3.9k ±5%, 1/4w	148064	1		
R65	Res, comp, 100Ω ±5%, 1/4w	147926	1		
R68	Res, comp, 510Ω ±5%, 1/4w	218032	1		
R70	Res, met flm, 35.7k ±1%, 1/8w	288480	1		
U1	IC, Hex inverter	327700	1		
U2 thru U7	Not used				
U8, U9, U17 U30, U33	IC, DTL, Quad, 2-Input, Nand Gate	327643	5		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
U10 thru U16	Not used				
U18	IC, TTL, Quad, 2-Input, Nor Gate	268540	1		
U19	Not used				
U20	IC, TTL, Quad, 2-Input, Nand	327676	1		
U21, U25, U26	IC, DTL, Dual, J-K Flip-Flop	327601	3		
U22	IC, DTL, Triple, 3-Input, Nand Gate	327742	1		
U34	Op. amp., metal case	271502	1		
U38	IC, TTL, Quad 2-Input AND Gate	386789	1		
	Socket, IC, dual-in line	387316	11		
	Socket, IC, dual-in line 14 pin	291542	2		

DENOTES FACTORY SELECTED PART

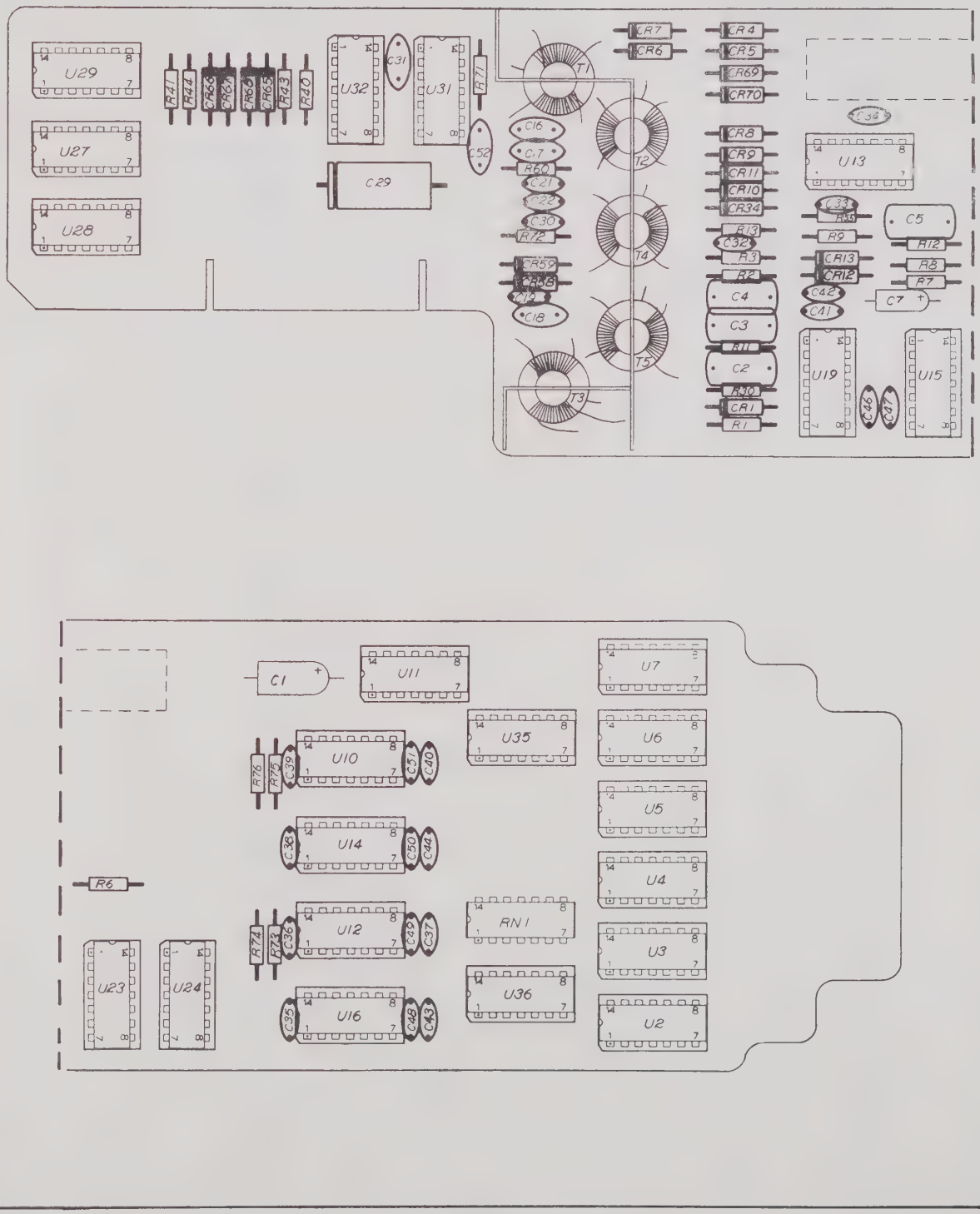


Figure 20. DATA OUTPUT UNIT NO. 1.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A7	**DATA OUTPUT UNIT NO. 1** **Figure 20**		REF		
C1	Cap, Ta, 33 uf ±10%, 10V	182832	1		
C2, C4	Cap, plstc, 0.1 uf ±10%, 250V	161992	2		
C3, C5	Cap, plstc, 0.027 uf ±10%, 250V	267120	2		
C6	Not used				
C7	Cap, Ta, 0.68 uf ±10%, 35V	182790	1		
C8 thru C15	Not used				
C16, C17, C18	Cap, cer, 0.22 uf ±20%, 50V	309849	3		
C19, C21, C22, C30, C33, C34, C37, C40, C43 thru C51	Cap, cer, 0.01 uf ±20%, 100V	149153	17		
C20, C23 thru C28	Not used				
C29	Cap, elect, 200 uf +50/-10%, 10V	236935	1		
C32, C41, C42	Cap, cer, 0.025 uf ±20%, 50V	168435	3		
C35, C36, C38, C39	Cap, cer, 0.0012 uf ±10%, 500V	106732	4		
C31	Cap, cer, 0.005 uf ±20%, 50V	105569	2		
CR1, CR4 thru CR13, CR34, CR58, CR59, CR56 thru CR70	Diode, germanium, 80 mA, 100 piv	149187	20		
CR2, CR3, CR14 thru CR32, CR35, CR42, thru CR49, CR57, CR60 thru CR64	Not used				
R1, R11	Res, comp, 100Ω ±5%, 1/4w	147926	2		
R2, R3, R72	Res, comp, 220 ±5%, 1/4w	147959	3		
R4, R5	Not used				
R6, R7, R13	Res, comp, 3.9k ±5%, 1/4w	148064	3		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R8, R40, R41, R43, R44	Res, comp, 470Ω ±5%, 1/4w	147983	5		
R9, R55	Res, comp, 12k ±5%, 1/4w	159731	2		
R10	Res, comp, 10k ±5%, 1/4w	148106	1		
R12	Res, comp, 1k ±5%, 1/4w	148023	1		
R15 thru R39, R42, R45 thru R54, R56 thru R59, R61 thru R70	Not used				
R71, R60	Res, comp, 390Ω ±5%, 1/4w	147975	2		
R73 thru R76	Res, comp, 27 ±5%, ¼W	160812	4		
RN1	Res, network 4.7k	386961	1		
T1 thru T5	Transformer	275362	5		
U1	Not used				
U2 thru U7, U11, U24, U27, U28, U29	IC, DTL, Quad, 2-Input Nand Gate	327643	11		
U8, U9	Not used				
U10, U12, U14, U16	IC, TTL, 8-Bit shift register	272138	4		
U11	Not used				
U13, U32	IC, DTL, Hex Inverter	327700	2		
U15, U19	IC, TTL, Quad, 2-Input Nor Gate	268540	2		
U17, U18, U20, U21, U22	Not used				
U35, U36	IC, TTL, Quad, 2-Input AND Gate	386789	2		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
U23	IC, DTL, Triple, 3-Input Nand Gate	327742	1		
U25, U26, U30	Not used				
U31	IC, TTL, Hex Inverter	327635	1		
	Connector, PCB to Cable, 34 contact	295337	1		
	Socket, IC, Dual-in line	387316	19		
	Socket, IC, Low profile, Dual-in-line	291542	4		

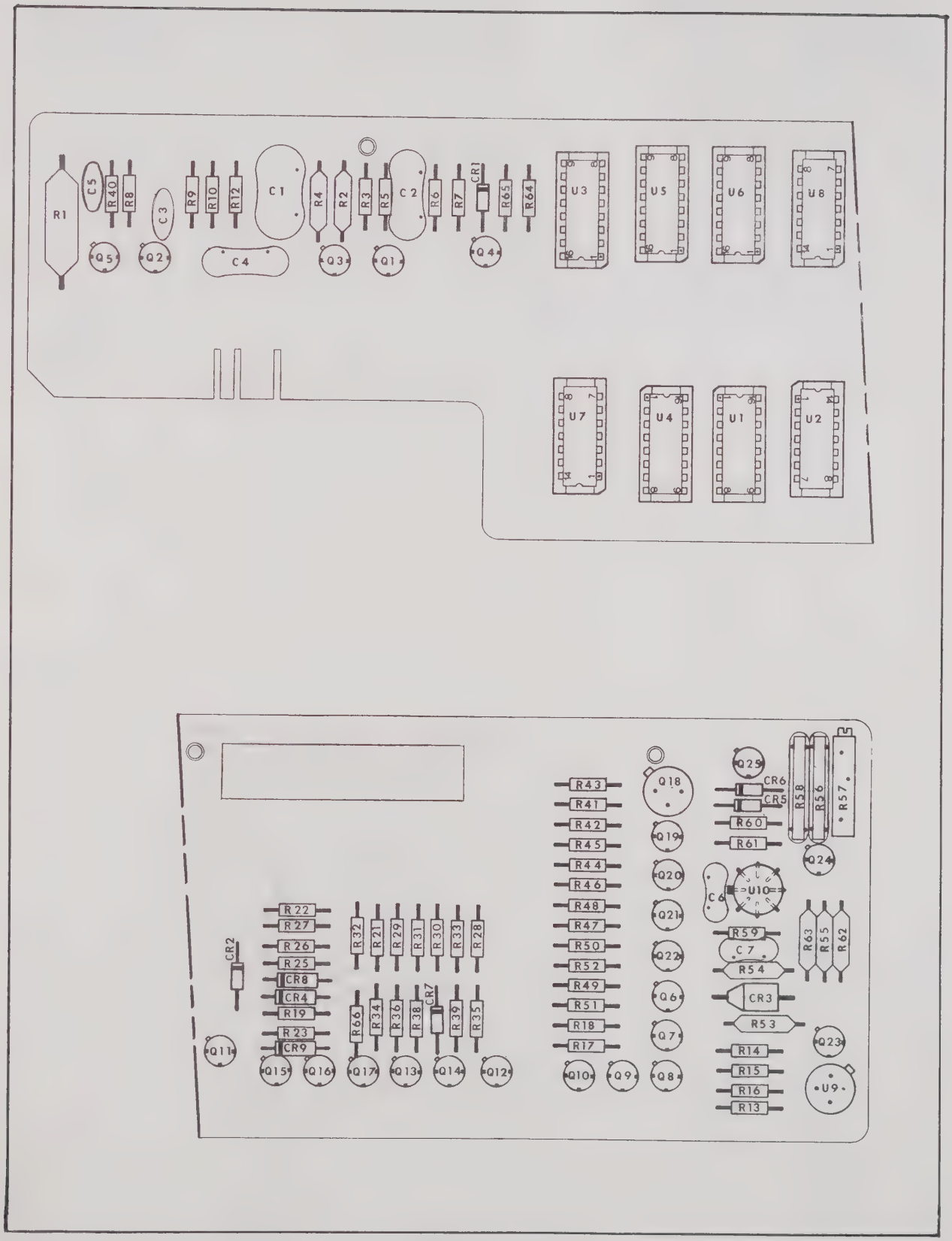


Figure 21. LOGIC ASSEMBLY.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A8	**LOGIC ASSEMBLY** **Figure 21**		REF		
C1	Cap, mica, 5600 pf ±2%, 500V	182873	1		
C2	Cap, mica, 1500 pf ±5%, 500V	148361	1		
C3	Cap, cer, 180 pf ±10%, 500V	105890	1		
C4	Cap, mica, 470 pf ±5%, 500V	148429	1		
C5	Cap, cer, 0.025 uf ±20%, 50V	168435	1		
C6	Cap, mica, 33 pf ±5%, 500V	160317	1		
C7	Cap, mica, 270 pf ±5%, 500V	148452	1		
C8	Cap, cer, 0.01 uf ±20%, 100V	149153	1		
CR1, CR2, CR5, CR6, CR7	Diode, silicon, 150 mA	203323	5		
CR3	Diode, rectifier, silicon	329672	1		
CR4, CR8, CR9	Diode, germanium, 80 mA, 100 piv	149187	3		
Q1	Tstr, silicon, unijunction, programmable	327718	1		
Q2, Q3, Q4, Q5, Q19 thru Q22, Q24	Tstr, silicon, NPN	328435	9		
Q6 thru Q17	Tstr, silicon, PNP	328427	12		
Q18	Tstr, germanium, semicon, PNP	148619	1		
Q23, Q25	Tstr, silicon, NPN	329698	2		
R1	Res, met flm, 750k ±1%, 1/2w	155192	1		
R2	Res, met flm, 110k ±1%, 1/8w	234708	1		
R3	Res, comp, 47Ω ±5%, 1/4w	147892	1		
R4	Res, met flm, 46.4k ±1%, 1/8w	188375	1		
R5, R19	Res, comp, 2.7k ±5%, 1/4w	170720	2		
R6, R21, R28, R29, R31 thru R33	Res, comp, 1.5k ±5%, 1/4w	148031	7		
R7	Res, comp, 820Ω ±5%, 1/4w	148015	1		
R8, R59, R60	Res, comp, 10k ±5%, 1/4w	148106	3		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R9	Res, comp, 27k ±5%, 1/4w	148148	1		
R10	Res, comp, 1k ±5%, 1/4w	148023	1		
R11	Not used				
R12, R40, R41	Res, comp, 4.7k ±5%, 1/4w	148072	3		
R13, R25, R26, R27	Res, comp, 8.2k ±5%, 1/4w	160796	4		
R14 thru R18	Res, comp, 51k ±5%, 1/4w	193334	5		
R20	Not used				
R22, R23	Res, comp, 2.2k ±5%, 1/4w	148049	2		
R30	Res, comp, 680Ω ±5%, 1/4w	148007	1		
R34, R35, R36, R38, R39	Res, comp, 22k ±5%, 1/4w	148130	5		
R37	Not used				
R42	Res, comp, 33k ±5%, 1/4w	148155	1		
R43	Res, comp, 47k ±5%, 1/4w	148163	1		
R44, R50, R52	Res, comp, 220k ±5%, 1/4w	160937	3		
R45, R46, R48, R49, R51, R65	Res, comp, 11k ±5%, 1/4w	221580	6		
R47	Res, comp, 39k ±5%, 1/4w	188466	1		
R53	Res, met flm, 182k ±1%, 1/8w	241091	1		
R54	Res, met flm, 3.74k ±1%, 1/8w	260547	1		
R55, R56 R62, U9	Res, amp set	290650	1		
R57	Res, var, cermet, 20Ω ±20%, 1/2w	261180	1		
R58	Res, ww, 14k ±0.1%, 1/4w	275321	1		
R61	Res, comp, 1.2k ±5%, 1/4w	190371	1		
R63	Res, met flm, 3.74k ±1%, 1/8w	272096	1		
R64, R66	Res, comp, 1.8k ±5%, 1/4w	175042	2		
U1, U3 thru U6	IC, TTL, Dual, J-K Flip-Flop	268441	5		
U2	IC, DTL, Dual, 4-Input Nand Gate	327692	1		
U7	IC, TTL, Dual 4-Input Nor Gate	268557	1		
U8	IC, DTL, Quad, 2-Input Nand Gate	327643	1		
U9	(See R55)				
U10	IC, Operational amplifier	271502	1		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A9	**A/D CONVERTER ASSEMBLY** **Figure 22**		REF		
C1, C3, C4, C5	Cap, mica, 390 pf ±5%, 500V	148437	4		
C2, C7	Cap, plstc, 0.47 uf ±10%, 250V	184366	2		
C6, C16, C18, C19	Cap, mica, 33 pf ±5%, 500V	160317	4		
C8	Cap, cer, 15 pf ±10%, 500V	159947	1		
C9, C10	Cap, plstc, 0.047 uf ±10%, 120V	260562	2		
C11 thru C15	Cap, cer, 0.01 uf ±20%, 100V	149153	5		
C17	Cap, plstc, 0.047 uf ±10%, 250V	162008	1		
C20	Cap, mica 2 pf ±10%, 500V	175208	1		
CR1, CR2, CR16	Diode, silicon, 150 mA, 125 piv	272252	3		
CR3, CR4, CR5, CR7 thru CR15	Diode, silicon, 150 mA	203323	12		
CR6	Diode, germanium, 80 mA, 100 piv	149187	1		
CR17	Diode, silicon, 75 mA, 90 piv	260554	1		
CR18	Diode, zener, semicon, 6.8V	187195	1		
Q1, Q21, Q45	Tstr, silicon, NPN	328435	3		
Q2, Q32	Tstr, silicon, PNP	328427	2		
Q3, Q6, Q19, Q22, Q23, Q24	Tstr, FET, N-channel	328245	6		
Q4,	Tstr, FET, Dual, N-channel	257501	1		
Q5, Q13 thru Q17, Q36	Tstr, FET, N-channel	328237	7		
Q7, Q8, Q9	Tstr, FET grouped, N-channel	329987	3		
Q10, Q11, Q29, Q33, Q34	Tstr, silicon, PNP	288761	5		
Q12, Q18	Tstr, J-FET, N-channel	328229	2		
Q20	Tstr, FET, dual, N-channel	267963	1		
Q25, thru Q28, Q31	Tstr, J-FET, N-channel	328211	5		
Q30	Tstr, silicon, PNP	321398	1		

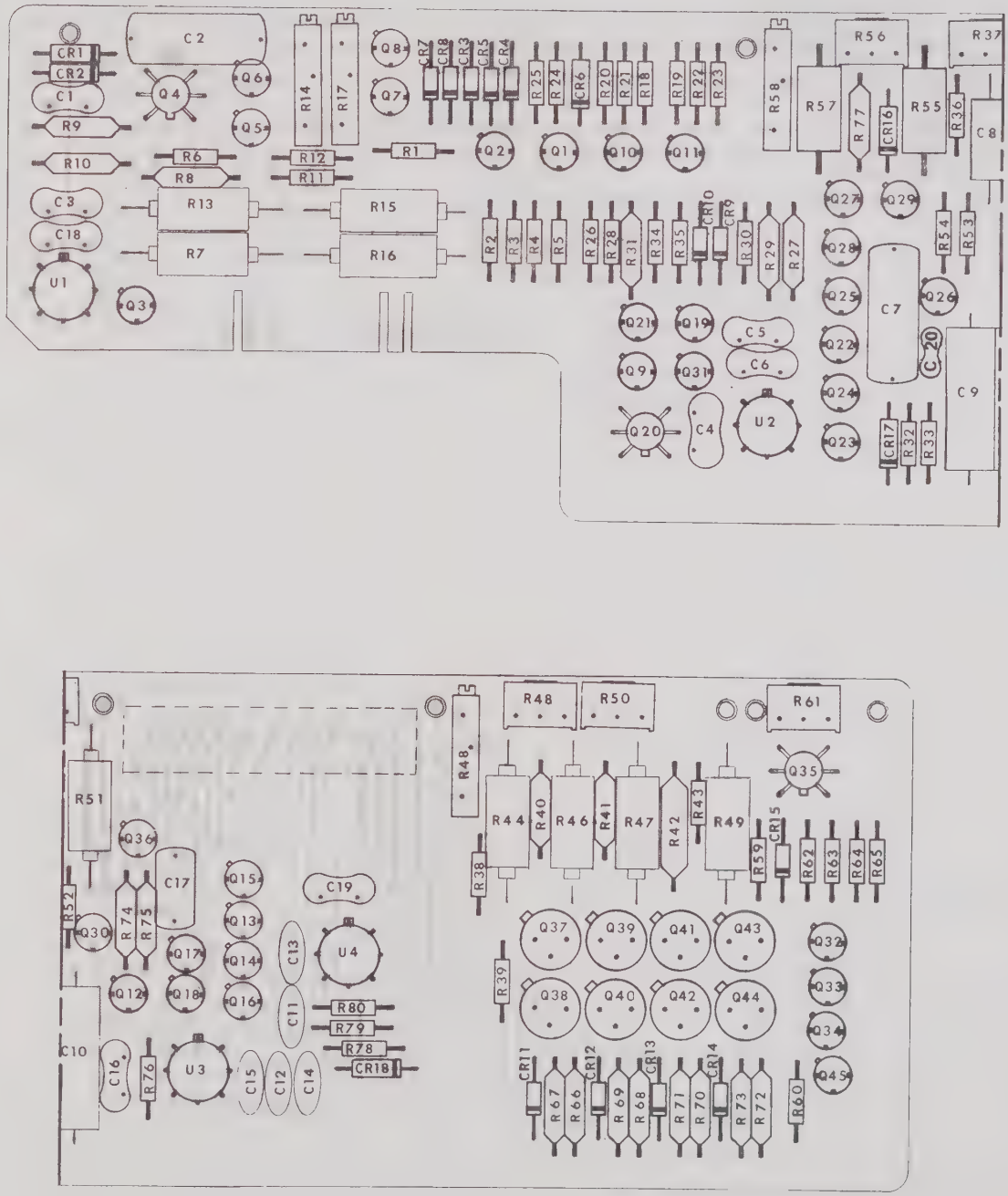


Figure 22. A/D CONVERTER ASSEMBLY.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
Q37, Q39, Q41, Q43	Tstr, germanium, NPN	306126	4		
Q35	Tstr, dual, silicon, NPN	295717	1		
Q38, Q40, Q42, Q44	Tstr, germanium, PNP	306118	4		
R1, R4, R18	Res, comp, 4.7k ±5%, 1/4w	148072	3		
R2, R3	Res, comp, 47k ±5%, 1/4w	148163	2		
R5, R34, R53, R62, R63, R80	Res, comp, 100k ±5%, 1/4w	148189	6		
R6, R36, R59, R64	Res, comp, 10k ±5%, 1/4w	148106	4		
R7, R13	Res, ww, 10k, matched set	291690	1		
R8, R9, R31	Res, met flm, 45.3k ±1%, 1/8w	234971	3		
R10	Res, met flm, 49.9k ±1%, 1/8w	268821	1		
R11	Res, comp, 68k ±5%, 1/4w	148171	1		
R12	Res, comp, 220Ω ±5%, 1/4w	147959	1		
R14, R17, R45	Res, var, cermet, 20Ω ±20%, 1/2w	261180	3		
R15, R16, R44, R46, R47, R49, R51	Res, ww, matched set	285239	1		
R19, R22	Res, comp, 33k ±5%, 1/4w	148155	2		
R20, R21	Res, comp, 22k ±5%, 1/4w	148130	2		
R23	Res, comp, 5.6k ±5%, 1/4w	148080	1		
R24, R25, R35	Res, comp, 220k ±5%, 1/4w	160937	3		
R26	Res, comp, 82Ω ±5%, 1/4w	149484	1		
R27	Res, met flm, 21.5k ±1%, 1/8w	168278	1		
R28, R78	Res, comp, 27k ±5%, 1/4w	148148	2		
R29	Res, met flm, 22.1k ±1%, 1/8w	235234	1		
R30	Res, comp, 820k ±5%, 1/4w	220541	1		
R32, R79	Res, comp, 15k ±5%, 1/4w	148114	2		
R33	Res, comp, 1k ±5%, 1/4w	148023	1		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R37	Res, var, cermet, 10k ±10%, 1/2w	285171	1		
R38, R39	Res, comp, 6.2M ±5%, 1/4w	221960	2		
R40, R41	Res, met flm, 750k ±1%, 1/8w	271361	2		
R42	Res, met flm, 1.5M ±1%, 1/4w	284976	1		
R43	Res, comp, 3M ±5%, 1/4w	221952	1		
R48	Res, var, cermet, 50Ω ±10%, 1w	285122	1		
R50	Res, var, cermet, 100Ω ±10%, 1w	285130	1		
R52	Res, comp, (Nominally 22Ω ±5%, 1/4w)	147884	1		
R54	Res, comp, 18k ±5%, 1/4w	148122	1		
R55	Res, ww, 1.022k ±0.05%, 1/4w	288654	1		
R56	Res, var, cermet, 20Ω ±10%, 1w	285114	1		
R57	Res, ww, 5k ±0.05%, 1/4w	288647	1		
R58	Res, var, cermet, 200Ω ±20%, 1/2w	284711	1		
R60	Res, comp, 150k ±5%, 1/4w	182212	1		
R61	Res, var, cermet, 200Ω ±10%, 1w	285148	1		
R65	Res, comp, 510k ±5%, 1/4w	275685	1		
R66, R68, R70, R72	Res, met flm, 4.99k ±1%, 1/8w	168252	4		
R67, R69, R71, R73	Res, met flm, 32.4k ±1%, 1/8w	182956	4		
R74	Res, met flm, 6.04k ±1%, 1/8w	285189	1		
R75	Res, met flm, 1k ±1%, 1/8w	168229	1		
R76	Res, comp, 270k ±5%, 1/4w	220061	1		
R77	Res, met flm, 16.9Ω ±1%, 1/8w	281790	1		
U1 thru U4	IC, Operational amplifier	271502	4		
	Connector, PCB to Cable, 34 contacts	295337	1		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A10	**ACTIVE FILTER** Figure 23	326843			
C1 thru C4	Cap, plstc, 0.47 uf ±20%, 120V	190553	4		
C5, C8	Cap, mica, 33 pf ±5%, 500V	160317	2		
C6, C7	Cap, mica, 150 pf ±5%, 500V	148478	2		
CR1, CR2	Diode, silicon 10 mA, 2 piv	180554	2		
CR3	Diode, silicon, 150 mA	203323	1		
K1	Coil, reed relay	272070	1		
K1A, K1B	Switch, reed, relay	219097	2		
Q1	Tstr, silicon, NPN, Super-beta dual monolithic	284075	1		
Q2	Tstr, silicon, NPN	328435	1		
Q3	Tstr, silicon, PNP	328427	1		
R1, R2, R4, R5	Res, met flm, 46.4k ±1%, 1/8w	188375	4		
R3	Res, comp, 6.8k ±5%, 1/4w	148098	1		
R6	Res, met flm, 140k ±1%, 1/8w	289439	1		
R7	Res, comp, 100k ±5%, 1/4w	148189	1		
R8	Res, met flm, 8.66k ±1%, 1/8w	260364	1		
R9, R10	Res, met flm, 215k ±1%, 1/8w	289470	2		
R13	Res, var, cermet, 5k ±20%, 1/2w	267872	1		
R14	Res, met flm, 100k ±1%, 1/8w	248807	1		
R15	Res, met flm, 2.49k ±1%, 1/8w	226209	1		
R16	Res, met flm. 82.5k ±1%, 1/8w	246223	1		
R17	Res, met flm, 2.k ±1%, 1/8w	235226	1		
R18	Res, met flm, 7.15k ±1%, 1/8w	260356	1		
U1, U2	IC, Operational amplifier	271502	2		

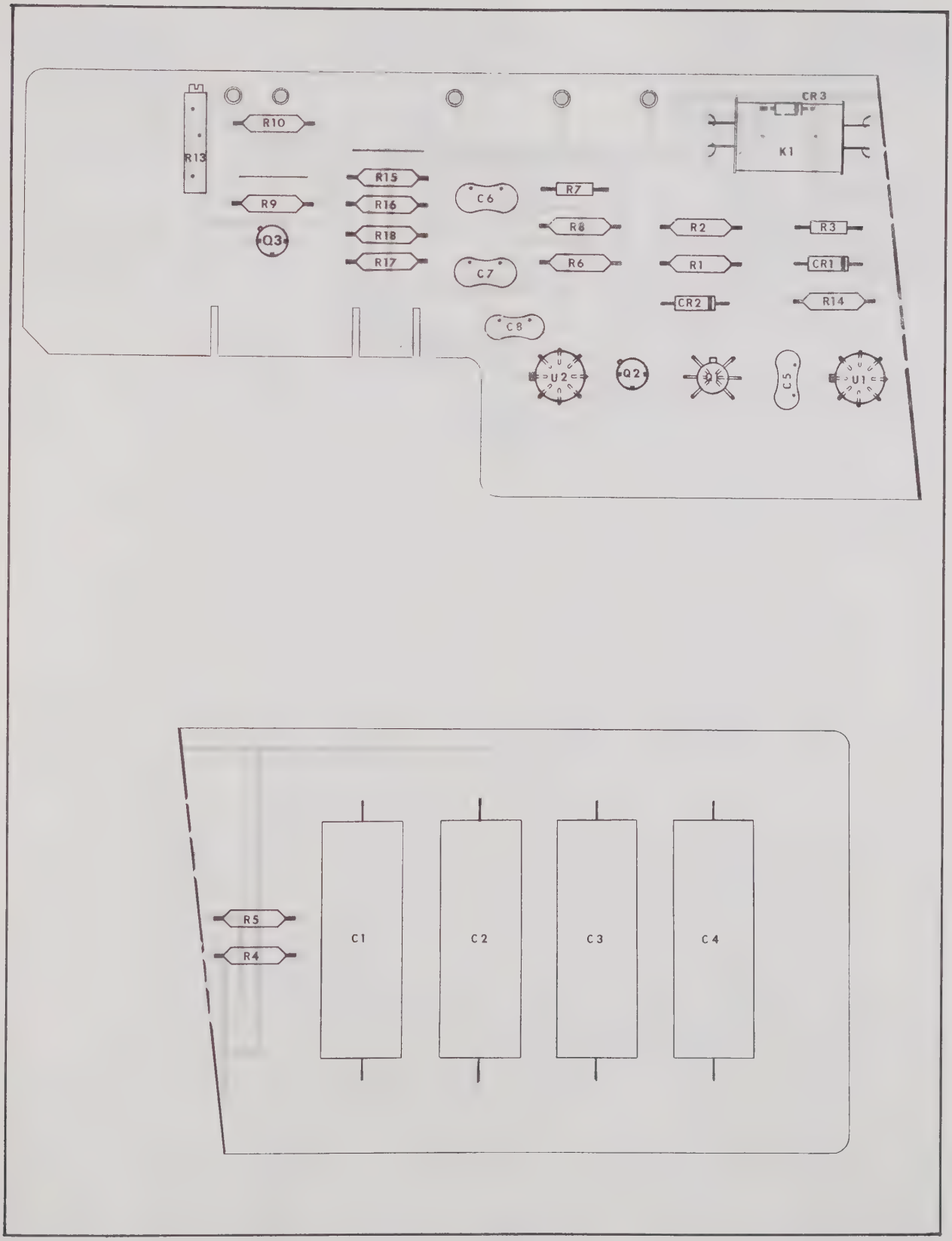


Figure 23. ACTIVE FILTER.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A11	**BUFFER AMP ASSEMBLY** Figure 24		REF		
C1, C3	Cap, mica, 100 pf ±5%, 500V	148494	2		
C2, C4	Cap, mica, 33 pf ±5%, 500V	160317	2		
C5	Cap, mica, 270 pf ±5%, 500V	148452	1		
C6, C7	Cap, cer, 0.05 uf ±20%, 50V	149161	2		
C8	Cap, plstc, 0.1 uf ±10%, 120V	167460	1		
C9, C10	Not used				
C11	Cap, mica, 2200 pf ±5%, 500V	148346	1		
CR1	Diode, silicon, 10 mA, 2 piv	180554	1		
CR2	Not used				
CR3	Diode, zener, 6.8V	166199	1		
CR4 thru CR8	Diode, silicon, 200 mA, 25 piv	190272	5		
CR9, CR13 thru CR16	Diode, germanium, 90 mA, 100 piv	149187	5		
CR10, CR11, CR12, CR17 thru CR24	Diode, silicon, 150 mA	203323	11		
K1, K7	Relay, 4 PDT	334425	2		
K2, K3	Switch, dry reed	284091	3		
K4, K5, K6	Switch, dry reed	289850	3		
	Coil, reed relay (used with K2)	272070	1		
	Coil, reed relay (used with K3, K4, K5, K6)	269019	4		
Q1, Q8	Tstr, silicon, PNP	328427	2		
Q2	Tstr, germanium, PNP, semicon	148643	1		
Q3	Tstr, silicon, NPN	329698	1		
Q4	Tstr, silicon, NPN	295717	1		
Q5	Tstr, silicon, NPN, super beta, dual monolithic	284075	1		
Q6, Q7	Tstr, silicon, PNP	331025	2		
Q9, Q10	Not used				
Q11	Tstr, silicon, PNP, selected	328443	1		
R1	Res, comp, 1M ±5%, 1/4w	182204	1		
R2	Res, comp, 47k ±5%, 1/4w	150219	1		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R3	Res, comp, 910k ±5%, 2w	110171	1		
R4	Not used				
R5, R6, R7, R10	Res, ww, Matched Input Divider Set	284505	1		
R8	Res, var, cermet, 1k ±20%, 1/2w	267856	1		
R9	Res, var, cermet, 100Ω ±20%, 1/2w	267823	1		
R11	Res, met flm, 10k ±1%, 1/8w	168260	1		
R12	Res, met flm, 13.7k ±1%, 1/8w	236752	1		
R13	Res, met flm, 34k ±1%, 1/8w	261602	1		
R14	Res, met flm, 2.61k ±1%, 1/8w	289983	1		
R15	Res, met flm, 232Ω ±1%, 1/8w (Factory selected item may not be installed)	289975	1		
R16	Res, met flm, 84.5k ±1%, 1/8w	229492	1		
R17	Res, var, cermet, 100k ±20%, 1/2w	268581	1		
R18, R19	Res, comp, 100M ±10%, 1/2w	190520	2		
R20, R33	Res, comp, 10k ±5%, 1/4w	148106	2		
R21	Res, comp, 270k ±5%, 1/4w	220061	1		
R22, R23 R25, R26	Res, (Factory selected component may not be installed)		1		
R24, R27	Res, met flm, 2M, Matched Set	290320	1		
R28	Res, var, cermet, 10k ±10%, 1/2w	285171	1		
R29	Res, met flm, 3.83M ±1%, 1/2w	289660	1		
R30, R31	Res, comp, 22k ±5%, 1/4w	148130	2		
R32	Res, comp, 470Ω ±5%, 1/4w	147983	1		
R34	Res, comp, 3.3k ±5%, 1/4w	148056	1		
R35, R37, R39	Res, Matched Output Divider Set	289686	1		
R36	Res, var, cermet, 200Ω ±20%, 1/2w	284711	1		
R38	Res, var, cermet, 20Ω ±20%, 1/2w	261180	1		
R40	Res, comp, 1Ω ±5%, 1/2w	218693	1		
R41	Res, met flm, 499k ±1%, 1/8w	268813	1		
R42	Res, comp, 1k ±5%, 1/4w	148023	1		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R43, R44	Res, comp, 330Ω ±5%, 1/4w	147967	2		
U1	IC, Operational amplifier	284760	1		
U2	IC, Operational amplifier	271502	1		
U3	IC, Linear, voltage follower	288365	1		
U4	IC, DTL, Quad, 2-Input, Nand power gate	327627	1		
	Socket, IC, 14 contact	387316	1		

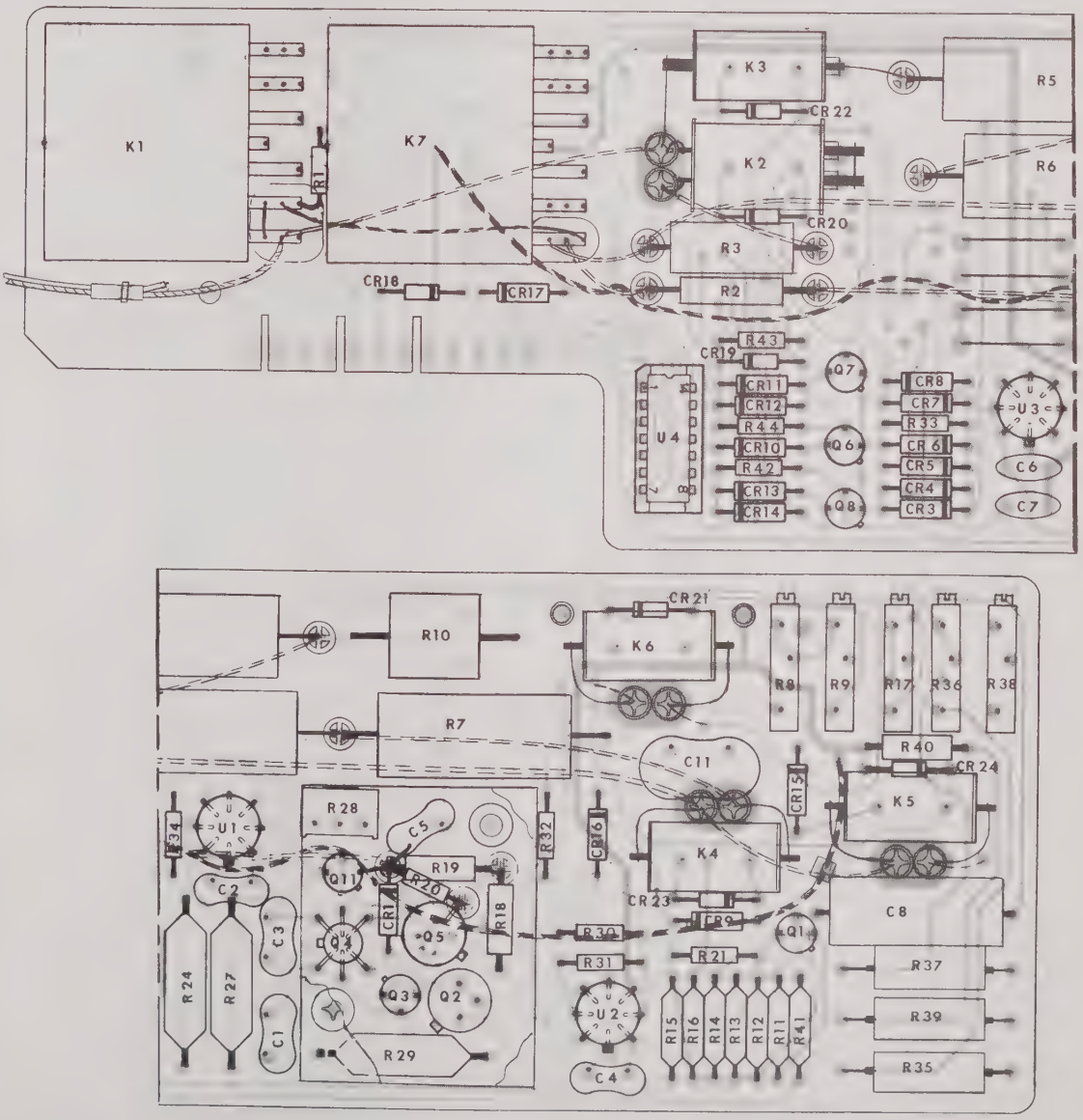


Figure 24. BUFFER AMP ASSEMBLY.

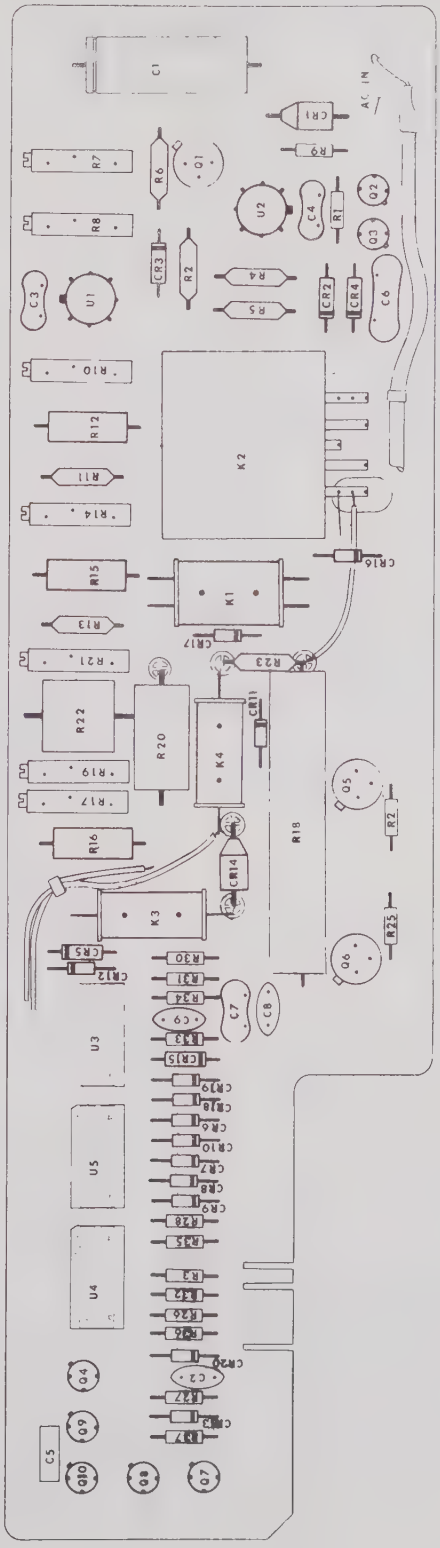


Figure 25. OHMS CONVERTER ASSEMBLY.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A12	**OHMS CONVERTER ASSEMBLY** **Figure 25**		REF		
C1	Cap, elect, 160 uf +50/-10%, 25V	236901	1		
C2, C8, C9	Cap, cer, 0.01 uf ±20%, 100V	149153	3		
C3, C4, C7	Cap, mica, 33 pf ±5%, 500V	160317	3		
C5	Cap, Ta, 1 uf ±20%, 35V	161919	1		
C6	Cap, mica, 470 pf ±5%, 500V	148429	1		
CR1	Diode, silicon, 1A, 200 piv	329672	1		
CR2	Diode, zener, 20V	180463	1		
CR3	Diode, zener 6.3V, Selected and Tested	288043	1		
CR4	Diode, silicon, 150 mA, 125 piv	272252	1		
CR5	Diode, zener, 10V	180406	1		
CR6 thru CR13, CR16 thru CR20	Diode, silicon, 150 mA	203323	13		
CR14	Diode, zener, 1 amp, 600 piv	112383	1		
CR15	Cap, germanium, 80 mA, 100 piv	149187	1		
K1 K1	Switch, dry reed Coil, reed relay	219097 272070	2 1		
K2	Relay, armature	309633	1		
K3, K4 K3, K4	Switch, dry reed Coil, reed relay	284091 269019	2 2		
Q1	Tstr, silicon, NPN	150359	1		
Q2, Q3	Tstr, silicon, PNP	329607	2		
Q4, Q7, Q9	Tstr, silicon, NPN	328435	3		
Q5, Q6	Tstr, silicon, PNP	331025	2		
Q8	Tstr, silicon, PNP	328427	2		
R1, R9	Res, comp, 10k ±5%, 1/4w	148106	2		
R2, R4	Res, met flm, 10k ±1%, 1/8w	168260	2		
R3	Res, comp, 2.2k ±5%, 1/4w	148049	1		
R5	Res, met flm, 953Ω ±1%, 1/8w	288555	1		
R6	Res, met flm, 619k ±1%, 1/8w	288639	1		
R7, R19	Res, var, cermet, 1k ±20%, 1/2w	267856	2		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R8, R17	Res, var, cermet, 25k ±20%, 1/2w	285213	2		
R10	Res, var, cermet, 10k ±20%, 1/2w	267880	1		
R11	Res, met flm, 46.4k ±1%, 1/8w	188375	1		
R12	Res, ww, 634.13Ω ±0.05%, 1/4w	292888	1		
R13	Res, met flm, 464k ±1%, 1/8w	271908	1		
R14	Res, var, cermet, 100k ±20%, 1/2w	268581	1		
R15	Res, ww, 6.983k ±0.05%, 1/4w	292896	1		
R16	Res, ww, 62k ±0.05%, 1/4w	292904	1		
R18	Res, met flm, 6.99M ±0.1%, 2w	284968	1		
R20	Res, ww, 777.15k ±0.05%, 3/4w	277913	1		
R21	Res, var, cermet, 100Ω ±20%, 1/2w	267823	1		
R22	Res, ww, 70.555k ±0.05%, 1/2w	277905	1		
R23	Res, met flm, 100Ω ±1%, 1/8w	168195	1		
R24, R25	Res, comp, 390Ω ±5%, 1/4w	147975	2		
R26	Res, comp, 8.2k ±5%, 1/4w	160796	1		
R27	Res, comp, 4.7k ±5%, 1/4w	148072	1		
R28, R33	Res, comp, 1k ±5%, 1/4w	148023	2		
R30, R31	Res, comp, 560Ω ±5%, 1/4w	147991	2		
R32	Res, comp, 220Ω ±5%, 1/4w	147959	1		
R34, R35, R36	Res, comp, 22k ±5%, ¼w	148130	3		
R37	Res, comp, 1M ±5%, ¼w	182204	1		
U1	IC, Operational amplifier	271502	1		
U2	IC, Operational amplifier	284760	1		
U3	IC, DTL, Triple, 3-Input, Nand Gate	327742	1		
U4	IC, DTL, dual, 4-Input, Nand Gate	327692	1		
U5	IC, DTL, Quad, 2-Input, Nand Gate	327643	1		
	Cable, Ohms assy	301754	1		
	Socket, IC, dual-in line	387316	3		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A13	**AC CONVERTER ASSEMBLY** **Figure 26**		REF		
C1	Cap, plstc, 0.22 uf ±20%, 1200V	268904	1		
C2	Cap, var, teflon, 0.25 - 1.5 pf, 2kV	273151	1		
C3, C4	Cap, var, air, 0.8 - 10 pf, 250V	229930	2		
C5	Cap, mica, 12 pf ±5%, 500V	175224	1		
C6, C18	Cap, var, cer, 9-35 pf, 350V	289637	2		
C7	Cap, mica, 150 pf ±1%, 500V	226134	1		
C8	Cap, mica, 4700 pf ±5%, 500V	208975	1		
C9	Cap, cer, 3 pf ±10%, 500V	226316	1		
C10, C14	Cap, Ta, 4.7 uf ±20%, 20V	161943	2		
C11	Cap, elect, 125 uf +50/-10%, 16V	186296	1		
C12, C13	Cap, cer, 500 pf ±10%, 1kV	105692	2		
C15	Cap, elect, 50 uf +50/-10%, 25V	168823	1		
C16, C17	Cap, cer, 0.01 uf ±20%, 100V	149153	2		
C19, C20	Cap, plstc, 0.068 uf, matched set	290148	1		
C21, C22	Cap, plstc, 0.12 uf, matched set	290130	1		
C23, C24	Cap, plstc, 0.0047 uf, matched set	290163	1		
C25, C26	Cap, plstc, 0.047 uf, matched set	288233	1		
C27	Cap, mica, 33 pf ±5%, 500V	160317	1		
C28 thru C31	Not used				
C32	Cap, mica, 56 pf ±500V	148528	1		
CR1, CR2, CR3, CR4, CR5, CR6, CR15	Diode, semicon, silicon, Low cap, Low leakage	348177	7		
CR7, CR8, CR9	Diode, silicon, 150 mA	203323	3		
CR10 thru CR14	Diode, germanium, 80 mA, 100 piv	149187	5		
CR16	Diode, zener, 13V	110726	1		
K1	Switch, dry reed	284091	1		
K2 thru K6	Switch, reed	219097	8		

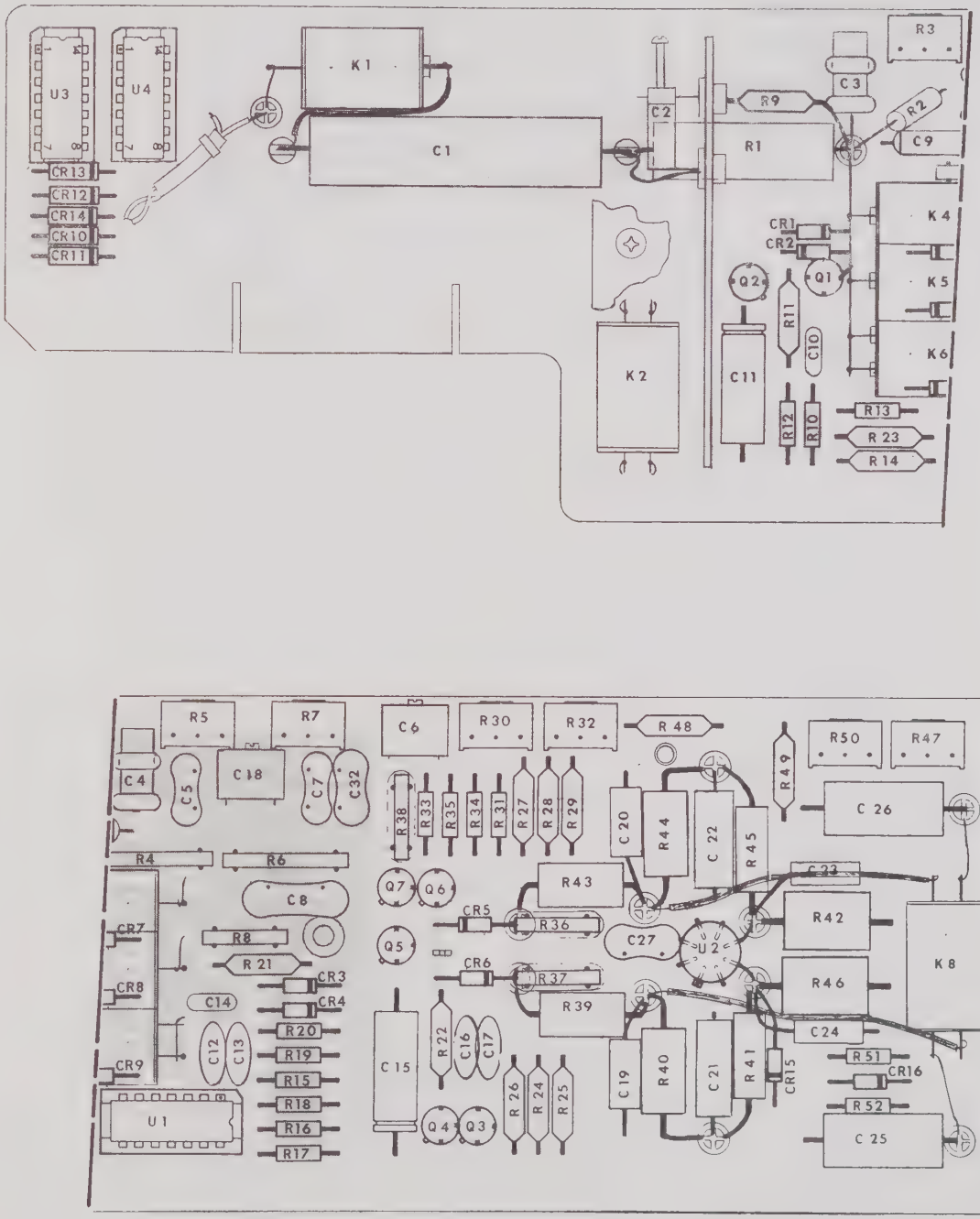


Figure 26. AC CONVERTER ASSEMBLY.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
	Coil, reed, relay (used with K1, K4, K5)	269019	3		
	Coil, reed relay (used with K2, K3, K6)	272070	3		
Q1,	Tstr, FET	327726	1		
Q2, Q6	Tstr, silicon, NPN	329698	2		
Q3, Q4, Q5, Q7	Tstr, silicon, PNP	331017	4		
R1, R2	Res, met flm, 1.11M and 267k, matched set	269092	1		
R3	Res, var, cermet, 2k ±10%, 1w	285163	1		
R4	Res, ww, 29.53k ±0.1%, 1/2w	277657	1		
R5, R32	Res, var, cermet, 200Ω ±10%, 1w	285148	2		
R6	Res, ww, 2.573k ±0.1%, 1/2w	277665	1		
R7	Res, var, cermet, 20Ω ±10%, 1w	285114	1		
R8	Res, ww, 143.3Ω ±0.1%, 1/4w	292193	1		
R9	Res, met flm, 49.9k ±1%, 1/8w	268821	1		
R10	Res, comp, 8.2k ±5%, 1/4w	160796	1		
R11, R26	Res, met flm, 590Ω ±1%, 1/8w	261883	2		
R12, R33	Res, comp, 10k ±5%, 1/4w	148106	2		
R13	Res, comp, 15k ±5%, 1/4w	148114	1		
R14	Res, met flm, 84.5k ±0.5%, 1/8w	229492	1		
R15, R18	Res, comp, 120k ±5%, 1/4w	193458	2		
R16, R17	Res, comp, 11k ±5%, 1/4w	221580	2		
R19, R20	Res, comp, 47Ω ±5%, 1/4w	147892	2		
R21, R22	Res, met flm, 40.2k ±1%, 1/8w	235333	2		
R23	Res, met flm, 82.5k ±1%, 1/8w	246223	1		
R24, R28	Res, met flm, 10k ±1%, 1/8w	168260	2		
R25, R27	Res, met flm, 21.5k ±1%, 1/8w	168278	2		
R29	Res, met flm, 1.1k ±1%, 1/8w	241497	1		
R30, R50	Res, var, cermet, 100k ±10%, 1w	288308	2		
R31	Res, comp, 10M ±5%, 1/4w	194944	1		
R34	Res, comp, 22k ±5%, 1/4w	148130	1		
R35	Res, comp, 2.2k ±5%, 1/4w	148049	1		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R36, R37	Res, ww, 1.702k ±0.1%, 1/4w	292201	2		
R38	Res, ww, 125Ω ±0.1%, 1/4w	249284	1		
R39, R40 R43, R44	Res, ww, 130k ±0.1%, 1/4w	285361	4		
R41, R45	Res, ww, 40k ±0.1%	271403	2		
R42, R46	Res, ww, 1M ±0.1%	271411	2		
R47	Res, var, cermet, 10k ±10%, 1/2w	285171	1		
R48	Res, met flm, 100Ω ±1%, 1/8w	168195	1		
R49	Res, met flm, 487k ±1%, 1/8w	237206	1		
R51	Res, comp, 9.1k ±5%, 1/4w	193318	1		
R52	Res, comp, 1k ±5%, 1/4w	148023	1		
U1	IC, 5 Tstr array, linear	327668	1		
U2	IC, Operational amplifier	288928	1		
U3	IC, DTL, Triple, 3-Input Nand Gate	327742	1		
U4	IC, DTL, Quad, 2-Input Nand Gate	327627	1		
	Connector, mating	277418	1		
	Socket, IC, dual in-line, 14 contact	387316	3		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A14	**DISPLAY AND INTERCONNECT PCB** **Figure 27**		REF		
A15	Function Enunciator	326835	1		
C1	Cap, cer, 0.05 uf ±20%, 50V	149161	1		
C2	Cap, cer, 300 pf ±10%, 500V	105734	1		
C3	Cap, elect, 22 uf +50/−10%, 25V	241356	1		
C4	Cap, cer, 0.025 uf ±20%, 50V	168435	1		
C5, C7	Cap, cer, 0.005 uf ±20%, 50V	175232	1		
C6	Cap, cer, 0.01 uf ±20%, 100V	149153	1		
C8	Cap, cer, 2000 pf, GMV, 1kV	105569	1		
C9	Cap, Ta, 0.22 uf ±20%, 35V	161331	1		
CR1, CR2, CR7, CR10, CR12, CR25 thru CR30, CR34	Diode, germanium, 80 mA, 100 piv	149187	12		
CR3, CR4	Not used				
CR5, CR6, CR8, CR9, CR11, CR13 thru CR17, CR31, CR32, CR33	Diode, silicon, 150 mA	203323	13		
Q1	Not used				
Q2, Q5	Tstr, silicon, PNP	328427	2		
Q3, Q6, Q7, Q19, Q20, Q34, Q35, Q36, Q38, Q39	Tstr, silicon, NPN	328435	10		
Q4, Q8	Tstr, unijunction, programmable, silicon	327718	2		
Q9 thru Q18, Q22 thru Q26	Tstr, silicon, NPN	218511	15		
Q21	Not used				
Q27 thru Q31	Tstr, silicon, PNP	328450	5		
Q32, Q33	Tstr, FET, N-channel	328237	2		
Q37	Tstr, silicon, NPN	329698	1		
R1, R3	Res, ww, 50k ±0.25%, 2w	307298	2		
R2, R4	Res, comp, 82k ±5%, 1/4w	188458	2		

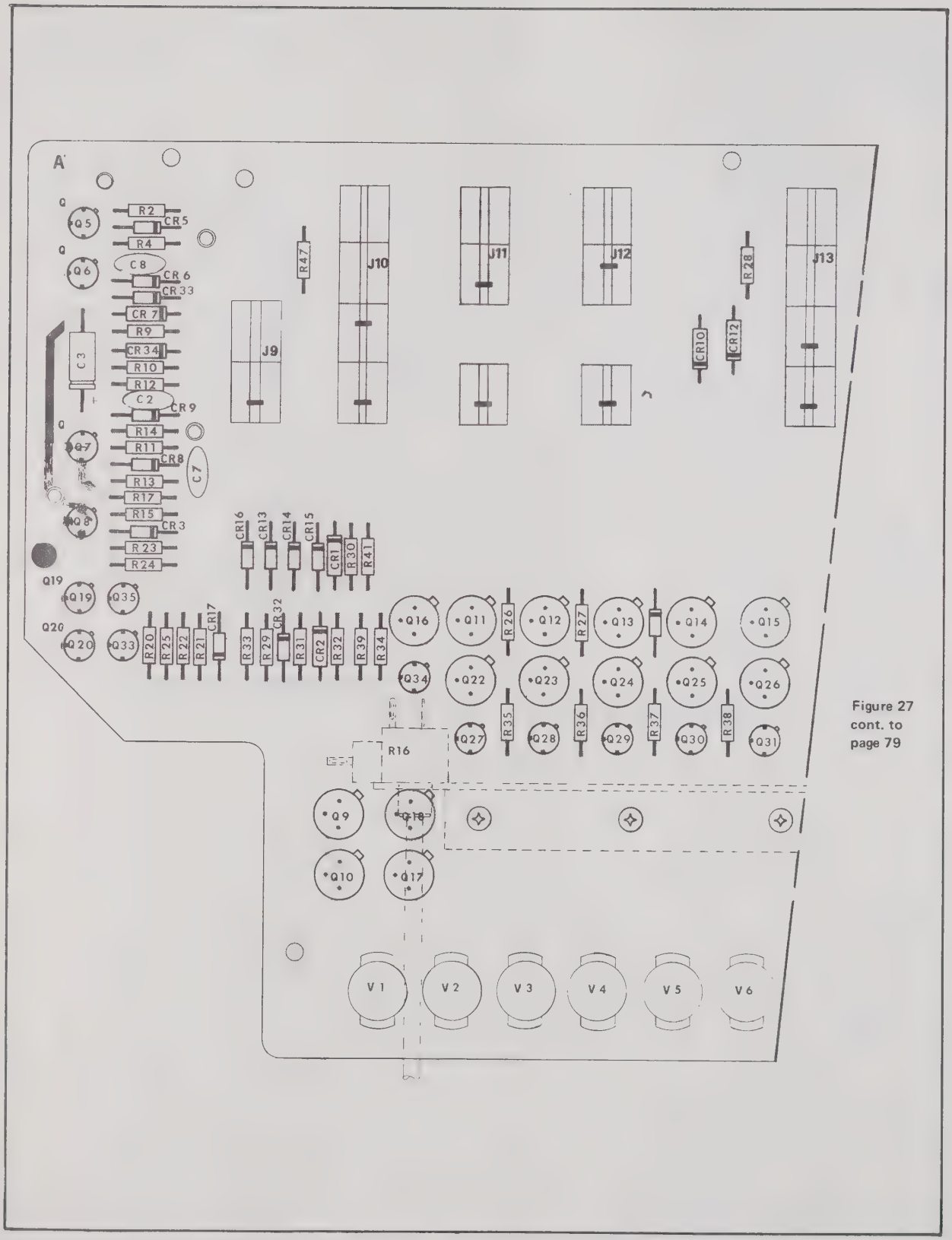


Figure 27 cont. to page 79

Figure 27. DISPLAY AND INTERCONNECT PCB.

Figure 27 cont. from page 78

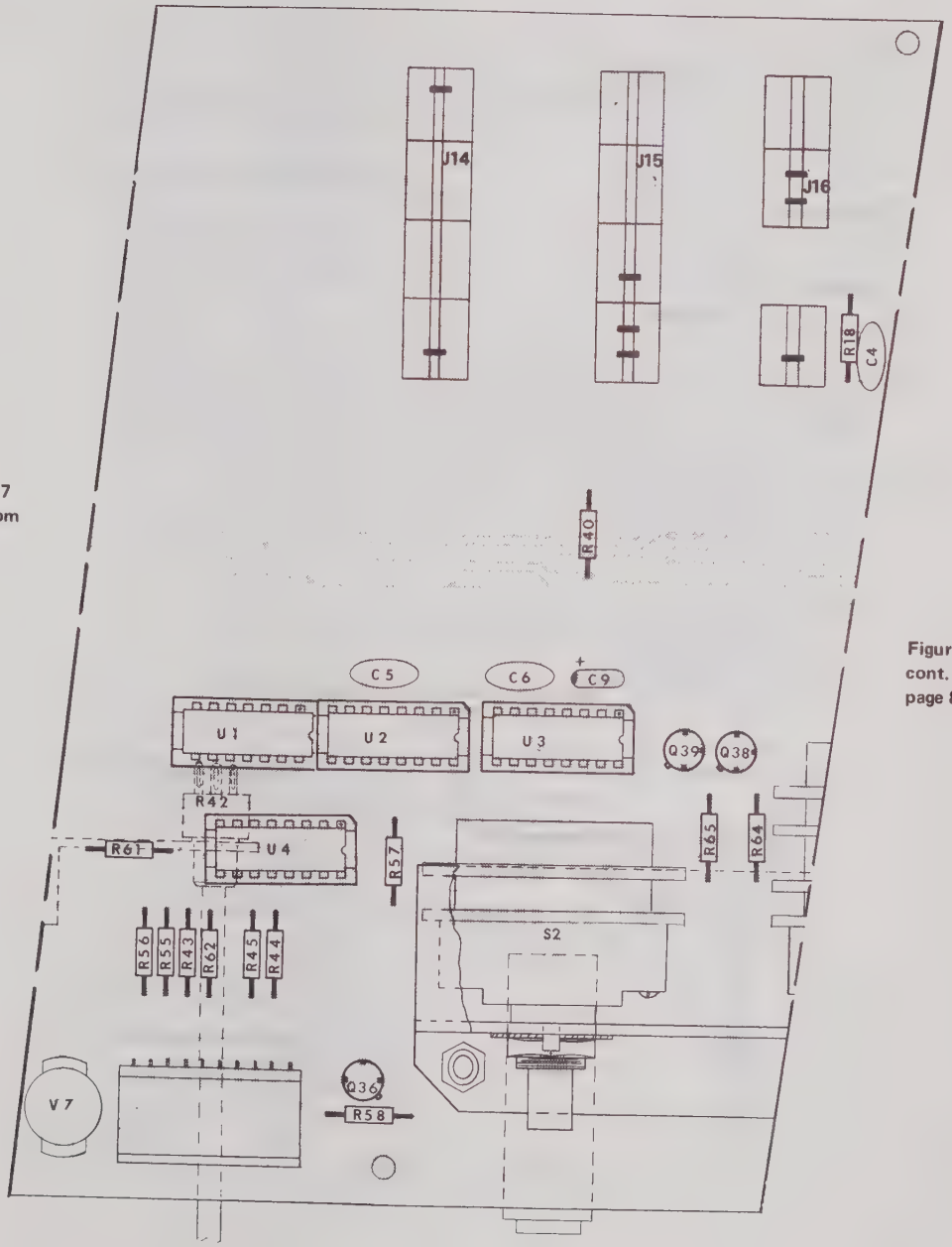


Figure 27 cont. to page 80

Figure 27. DISPLAY AND INTERCONNECT PCB

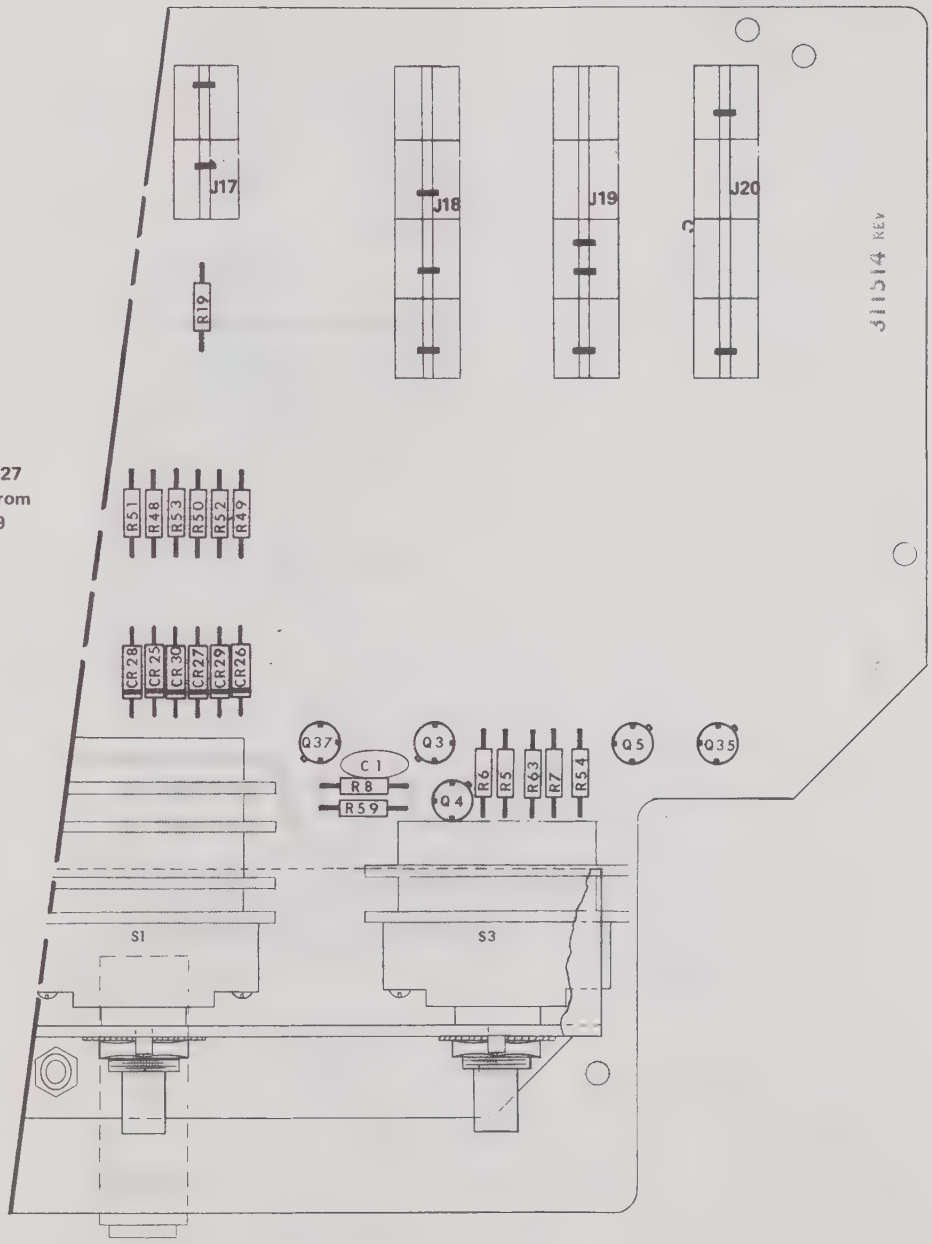


Figure 27
cont. from
page 79

Figure 27. DISPLAY AND INTERCONNECT PCB

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R5	Res, comp, 6.8k ±5%, 1/4w	148098	1		
R6, R11, R20, R25	Res, comp, 3.9k ±5%, 1/4w	148064	4		
R7, R58	Res, comp, 470Ω ±5%, 1/4w	147983	2		
R8, R18	Res, comp, 2.7k ±5%, 1/4w	170720	2		
R9	Res, comp,1.2k ±5%, 1/4w	190371	1		
R10	Res, comp, 1k ±5%, 1/4w	148023	1		
R12	Res, comp, 75k ±5%, 1/4w	220525	1		
R13, R30	Res, comp, 2.2k ±5%, 1/4w	148049	2		
R14, R57	Res, comp, 33k ±5%, 1/4w	148155	2		
R15	Res, comp, 27Ω ±5%, 1/4w	160812	1		
R16	Res, var, 100k ±10%, 1/2w	330902	1		
R17	Res, comp, 1.8k ±5%, 1/4w	175042	1		
R19, R48 thru R54, R63, R64, R65	Res, comp, 10k ±5%, 1/4w	148106	11		
R21, R22, R59	Res, comp, 390Ω ±5%, 1/4w	147975	3		
R23, R24	Res, comp, 16k ±5%, 1/4w	221606	2		
R26, R27 R28	Res, comp, 1.2k ±5%, 1/4w	190371	3		
R29, R34 thru R38, R61	Res, comp, 8.2k ±5%, 1/4w	160796	7		
R31, R39	Res, comp, 430Ω ±5%, 1/4w	203869	2		
R32	Res, comp, 330Ω ±5%, 1/4w	147967	1		
R33	Res, comp, 470k ±5%, 1/4w	188441	1		
R40	Res, comp, 4.7 ±5%, 1/4W	148130	1		
R41	Res, comp, 5.1k ±5%, 1/4w	193342	1		
R42	Res, var, cermet, 100k ±20%, 1/4w	330894	1		
R43, R44, R45, R55, R56, R62	Res, comp, 39Ω ±5%, 1/4w	193391	6		
R46	Not used				
R47	Res, comp, 3.3k ±5%, 1/4w	148056	1		
R60	Not used				

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
S1	Switch, rotary, 7 pos, 4 deck, 4 poles	329557	1		
S2	Switch, rotary, 4 pos, 2 deck, 6 poles	329565	1		
S3	Switch, rotary, 5 pos, 2 deck, 4 poles	329573	1		
U1	IC, Hex inverter	327775	1		
U2, U3	IC, TTL, Dual J-K Flip-Flop	268441	2		
U4	IC, Decoder Driver	267211	1		
V1	Tube, read out	272922	1		
V2 thru V7	Tube, read out	271494	6		
XF1, XF2	Fuse holder,	329375	2		
	Connector, edgeboard	291708	1		
	Socket, IC, dual-in line, 14 contacts	291542	1		
	Socket, IC, dual-in line, 16 contacts	291534	3		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A16	**DATA OUTPUT UNIT POWER** **Figure 28**	333427	REF		
C1, C2	Cap, elect, 7100 uf +75/-10%, 10V	295196	2		
CR1 thru CR4	Diode, silicon, rectifier, 200 to 1000V, 3 amp	331090	4		

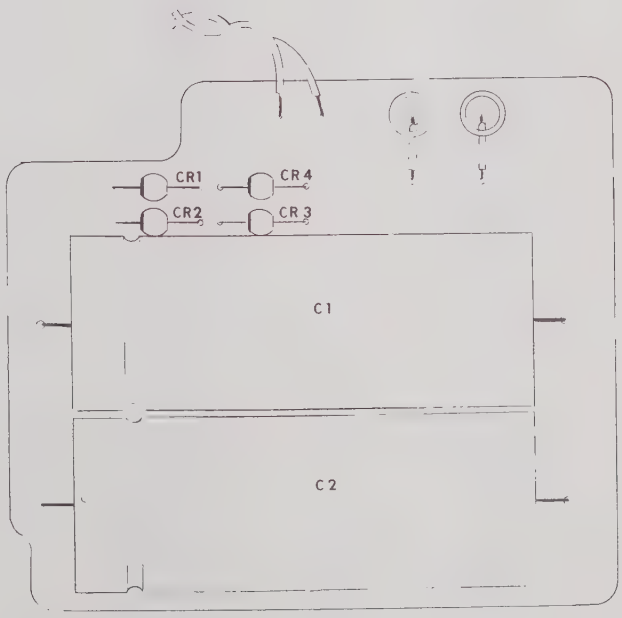


Figure 28. DATA OUTPUT UNIT POWER.

MANUFACTURERS' CROSS REFERENCE LIST

FLUKE STOCK NO.	MFR.	MFR. PART NO.	FLUKE STOCK NO.	MFR.	MFR. PART NO.
105569	71590	DA140-139CB	148080	01121	CB5625
105668	56289	C023B501J103M	148098	01121	CB6825
105692	71590	2DDH60N501K	148106	01121	CB1035
105734	71590	BB60301KW7W	148114	01121	CB1535
105890	71590	BB60181KS3N	148122	01121	CB1835
106054	56289	192P47202	148130	01121	CB2235
106732	71590	CF122	148148	01121	CB2735
108308	01121	EB4751	148155	01121	CB3335
108951	01121	EB5115	148163	01121	CB4735
110171	01121	HB9145	148171	01121	CB6835
110726	07910	1N964B	148189	01121	CB1045
112383	05277	1N4822	148346	14655	CD19F222J
113316	07910	1N748	148361	14655	CD19F152J
144717	01121	EB5115	148429	14655	CD19F471J
147884	01121	CB2215	148437	14655	CD15F391J
147892	01121	CB4705	148452	14655	CD15F271J
147926	01121	CB1015	148478	14655	CD15F151J
147934	01121	CB1515	148494	14655	CD15F101J
147959	01121	CB2215	148528	14655	CD15F560J
147967	01121	CB3315	148536	14655	CD15E470J
147975	01121	CB3915	148619	01295	2N1303
147983	01121	CB4715	148643	01295	2N1307
147991	01121	CB5615	149153	56289	C023B101F103M
148007	01121	CB6815	149161	56289	55C23A1
148015	01121	CB8215	149187	93332	1N270
148023	01121	CB1025	149484	01121	CB8205
148031	01121	CB1525	150219	01121	GB4735
148049	01121	CB2225	150359	95303	2N3053
148056	01121	CB3325	155192	91637	Type MFF 1/2
148064	01121	CB3925	159731	01121	CB1215
148072	01121	CB4725	159780	07910	1N759

MANUFACTURERS' CROSS REFERENCE LIST

FLUKE STOCK NO.	MFR.	MFR. PART NO.
159947	00656	Type C1-1
160226	05397	K2R2C20K
160317	14655	CD15E330J
160796	01121	CB8225
160804	01121	CB2715
160812	01121	CB2705
160937	01121	CB2245
161331	56289	196D224X0035
161810	03877	SG5658
161919	56289	196D105X0035
161943	56289	196D475X0020
161919	56289	196D105X0035
161992	73445	C280AEA100K
162008	73445	C280AEA47K
163915	56289	196D396X0006
166199	07910	1N754
167460	84411	Type 836UW-JF39
168195	91637	Type MFF 1/8
168229	91637	Type MFF 1/8
168252	91637	Type MFF 1/8
168260	91637	Type MFF 1/8
168278	91637	Type MFF 1/8
168385	84171	PE103G
168435	56289	C128B101H253M
168823	73445	C426ARF50
170423	14655	CD15F221J
170720	01121	CB2725
170738	01121	CB5635
175042	01121	CB1825
175224	14655	CD15E120J
175232	56289	C023B101E502M
177980	14655	CD15F431J
177998	14655	CD15E270J
178616	73445	C437ARG250
180406	07910	1N758
180463	07910	1N968B
180505	18927	1N276
180554	07910	CD12599
182204	01121	CB1055
182212	01121	CB1545
182790	56289	150D684X8035A2
182808	56289	150D337X9015A
182832	56289	150D336X9010B2
182873	14655	CD19F562G
182956	91637	Type MFF 1/8
184366	73445	C280AE/A470K
186296	73445	C426ARE125
187195	07910	CD36554
188375	91637	Type MFF 1/8
188441	01121	CB4745
188458	01121	CB8235
188466	01121	CB3935
190272	93332	1N456A
190371	01121	CB1225
190520	01121	EB1071
190553	84411	Type 863UW
193052	80294	3329H-1-101
193318	01121	CB9125
193334	01121	CB1535
193342	01121	CB5125
193375	01121	CB4325
193391	01121	CB3905
193441	01121	CB1845
193458	01121	CB1245
194803	73445	C280AEA220K

MANUFACTURERS' CROSS REFERENCE LIST

FLUKE STOCK NO.	MFR.	MFR. PART NO.	FLUKE STOCK NO.	MFR.	MFR. PART NO.
194944	01121	CB1065	235309	91637	Type MFF 1/8
198390	01121	CB2255	235333	91637	Type MFF 1/8
202879	01121	CB2035	236752	91637	Type MFF 1/8
203323	03508	DHD1105	236901	73445	C427ARF160
203869	01121	CB4315	236935	73445	C426ARD200
204891	89536	204891	237206	91637	Type MFF 1/8
208975	14655	CD19F472J	237297	91637	Type MFF 1/8
218032	01121	CB5125	240937	89536	240937
218511	95303	60994	241091	91637	Type MFF 1/8
218693	01121	EB10G5	241356	73445	C426A4E20
219097	15898	765972	241471	91637	Type MFF 1/8
220061	01121	CB2735	241497	91637	Type MFF 1/8
220525	01121	CB7535	246223	91637	Type MFF 1/8
220541	01121	CB8245	248807	91637	Type MFF 1/8
221580	01121	CB1135	249052	07910	1N9638
221606	01121	CB1635	249284	89536	249284
221903	01121	CB6225	257501	17896	DN423
221911	01121	CB6235	260356	91637	Type MFF 1/8
221952	01121	CB3055	260364	91637	Type MFF 1/8
221960	01121	CB6255	260547	91637	Type MFF 1/8
223602	95303	2N3442	260554	07910	CD55105
226134	14655	CD15F151F500	260562	84411	863UW47391
226209	91637	Type MFF 1/8	261180	71450	190PC200B
226316	00656	Type C1-1	261370	22767	S1330
229146	91637	Type MFF 1/8	261602	91637	Type MFF 1/8
229492	91637	Type MFF 1/8	261651	91637	Type MFF 1/8
229930	91293	JMC2951	261669	91637	Type MFF 1/8
233148	91637	Type MFF 1/8	261883	91637	Type MFF 1/8
234708	91637	Type MFF 1/8	267120	73445	C280AE/A27K
234971	91637	Type MFF 1/8	267146	91637	Type MFF 1/8
235226	91637	Type MFF 1/8	267211	12040	DM8840N
235234	91637	Type MFF 1/8	267229	91637	Type MFF 1/8

MANUFACTURERS' CROSS REFERENCE LIST

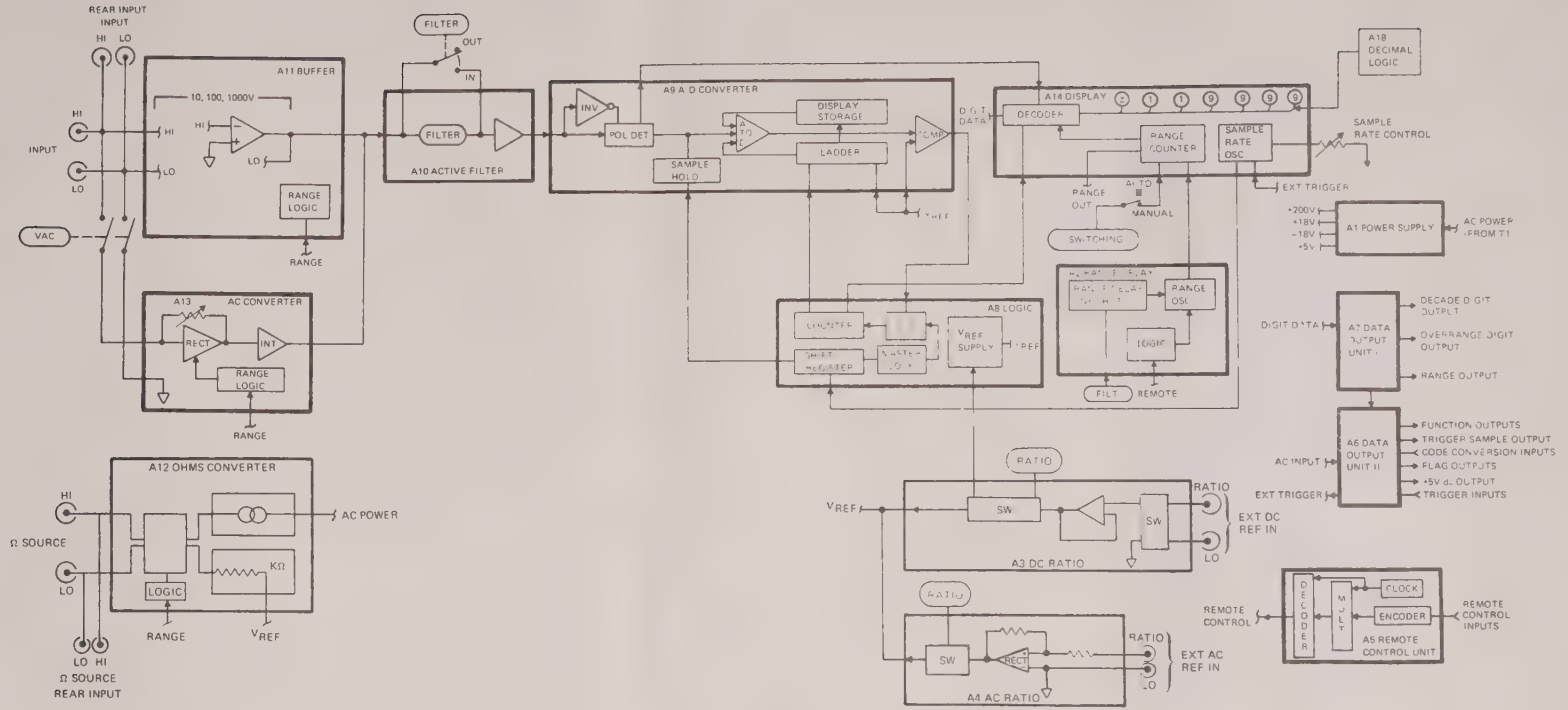
FLUKE STOCK NO.	MFR.	MFR. PART NO.
267344	91637	Type MFF 1/8
267823	71450	190PC101B
267856	71450	190PC102B
267872	71450	190PC502B
267963	17896	2N5197
267872	71450	190PC502B
267880	71450	190PC103B
268011	AMI	T-1483
268417	91637	Type MFF 1/8
268441	18324	C4312A
268540	18324	C4319A
268557	18324	C4321A
268581	71450	190PC104B
268789	91637	Type MFF 1/8
268813	91637	Type MFF 1/8
268821	91637	Type MFF 1/8
268904	84411	Type X663F
269019	71707	U-6-P
269076	95303	2N4037
269092	89536	269092
271320	56289	150D335X5020B2
271338	56289	150D033X020A
271361	91637	Type MFF 1/8
271403	54294	Type SP22
271411	54294	Type VA32
271494	83594	35853
271502	12040	LM301A
271908	91637	Type MFF 1/8
272070	71707	UD-6-P
272096	91637	Type MFF 1/8
272138	12040	DM8570
272252	07263	FD333
272716	77342	Type R40
272922	83594	B25866ST
273151	74970	273-1-2
275321	89536	275321
275362	89536	275362
275685	01121	CB5145
275792	56289	39D805G350GE4
276527	23880	TSA-2900-14W
276535	23880	TSA-2900-16W
277418	AMP	86144
277657	89536	277657
277665	89536	277665
277905	89536	277905
277913	89536	277913
278309	89536	278309
281790	91637	Type MFF 1/8
283697	91637	Type MFF 1/8
284075	11726	QD200-78
284091	12617	Type MRR5
284505	89536	284505
284711	71450	190PC201B
284760	12040	LM308H
284968	75042	Type MEH
284976	91637	Type MFF 1/4
285114	71450	360S-200A
285122	71450	360S-500A
285130	71450	360S-101A
285148	71450	360S-201A
285155	71450	360S-102A
285163	71450	360S-202A

MANUFACTURERS' CROSS REFERENCE LIST

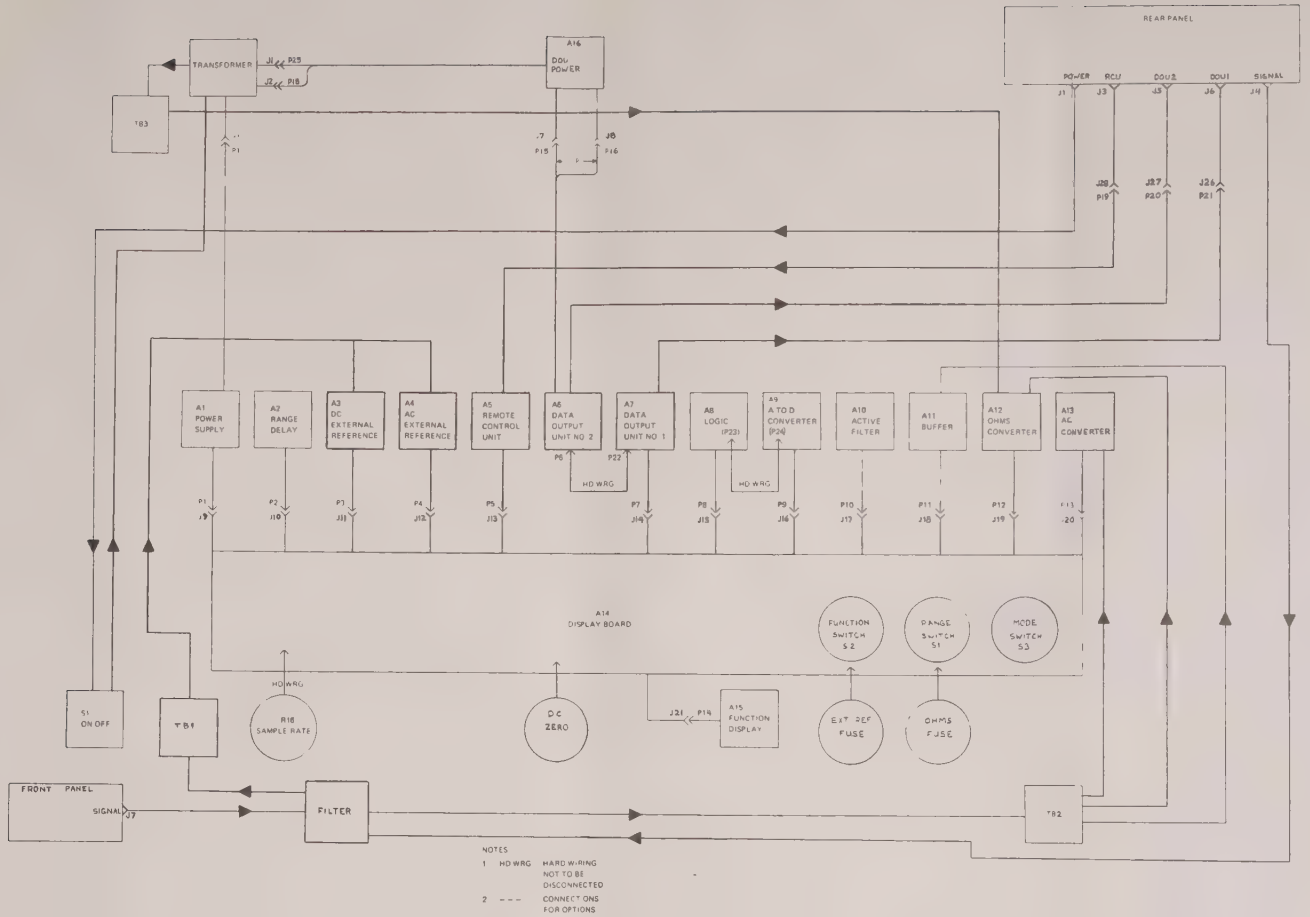
FLUKE STOCK NO.	MFR.	MFR. PART NO.
285171	71450	360S-103A
285189	91637	Type MFF 1/8
285213	71450	190PC253B
285239	89536	285239
285361	89536	285361
288043	89536	288043
288225	89536	288225
288233	89536	288233
288308	71450	360S-104A
288365	12040	LM310H
288480	91637	Type MFF 1/8
288498	91637	Type MFF 1/8
288555	91637	Type MFF 1/8
288563	91637	Type MFF 1/8
288639	91637	Type MFF 1/8
288647	89536	288647
288654	89536	288654
288928	12040	LM308AH
289066	91637	Type MFF 1/8
289439	91637	Type MFF 1/8
289470	91637	Type MFF 1/8
289637	72982	538-006D-9-35
289660	00327	Type M12
289686	89536	289686
289850	12617	Type MRR2
289975	91637	Type MFF 1/8
289983	91637	Type MFF 1/8
290130	89536	290130
290148	89536	290148
290163	89536	290163
290320	89536	290320
290650	89536	290650
291120	71450	360S-501A
291294	91637	Type MFF 1/8
291534	AMP	583529
291542	AMP	583527
291609	71450	360S-203A
291690	89536	291690
291708	ELCO	6308-006-313-003
292193	89536	292193
292201	89536	292201
292888	89536	292888
292896	89536	292896
292904	89536	292904
292946	71785	133-59-02-011
295121	89536	295121
295196	56289	39D718G010JP4
295337	28213	3402
295535	89536	295535
299610	89536	299610
301754	89536	301754
306118	01295	GA3938A
306126	01295	GA3937A
307298	89536	307298
309633	89536	309633
309849	32897	8121-05U-651-022M
311514	89536	311514
321216	28480	5082-3080
321398	89536	321398
326744	89536	326744

MANUFACTURERS' CROSS REFERENCE LIST

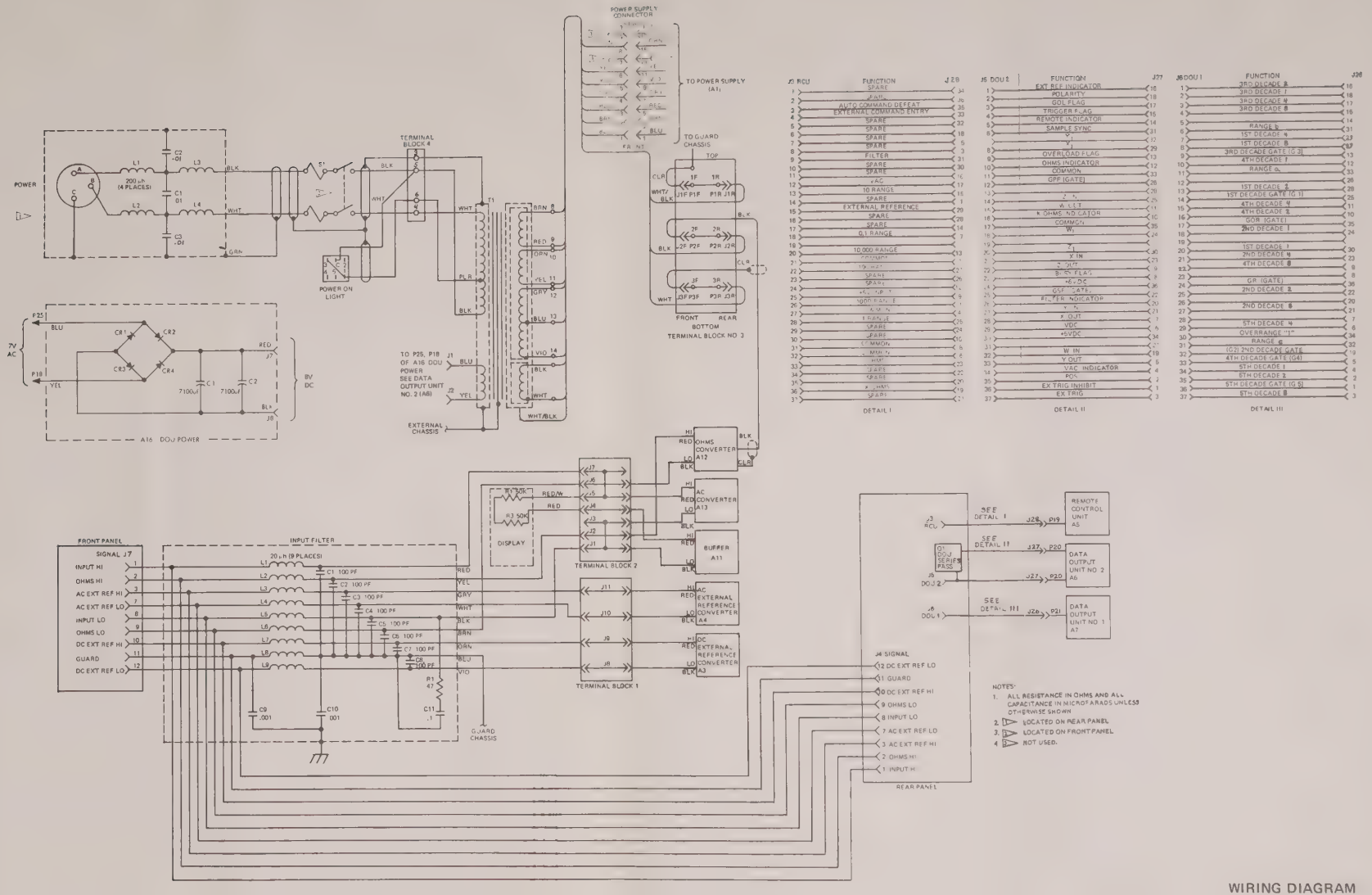
FLUKE STOCK NO.	MFR.	MFR. PART NO.
326751	89536	326751
326769	89536	326769
326777	89536	326777
326785	89536	326785
326793	89536	326793
326801	89536	326801
326835	89536	326835
326843	89536	326843
326850	89536	326850
326868	89536	326868
326876	89536	326876
327601	89536	327601
327627	89536	327627
327635	89536	327635
327643	89536	324643
327650	89536	327650
327668	89536	327668
327676	89536	327676
327684	89536	327684
327692	89536	327692
327700	89536	327700
327718	GE	D13K1
327726	89536	327726
327742	89536	327742
327767	89536	327767
327775	89536	327775
327783	89536	327783
328203	89536	328203
328211	45413	U2495
328229	89536	328229
328237	07263	2N4416
328245	TSC	U2511
328427	CTS	TM3906
328435	CTS	TM3904
328443	89536	328443
328450	07263	2N3930
329375	89536	329375
329383	89536	329383
329391	89536	329391
329557	89536	329557
329565	89536	329565
329573	89536	329573
329607	07263	2N3964
329654	89536	329654
329698	89536	329698
329987	89536	329987
330894	11236	Type 660
330902	89536	330902
331017	04713	2N3898
331025	07263	S37350
331090	14099	3SM2
334003	01295	2N3055
333427	89536	333427
334425	89536	334425
336180	89536	336180
336354	89536	336354
336362	89536	336362
336370	89536	336370
336388	89536	336388



BLOCK DIAGRAM
DRAWING NO 8425A 1500



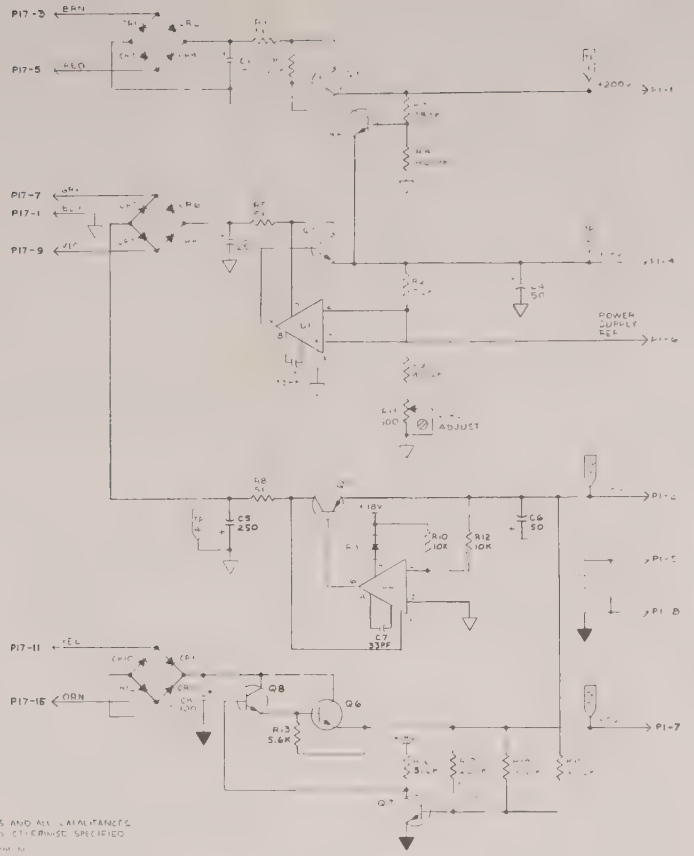
INTERCONNECT DIAGRAM
Drawing No. 8425A-1100



NOTES:

1. ALL RESISTANCE IN OHMS AND ALL CAPACITANCE IN MICROFARADS UNLESS OTHERWISE SHOWN
2. LOCATED ON REAR PANEL
3. LOCATED ON FRONT PANEL
4. NOT USED.

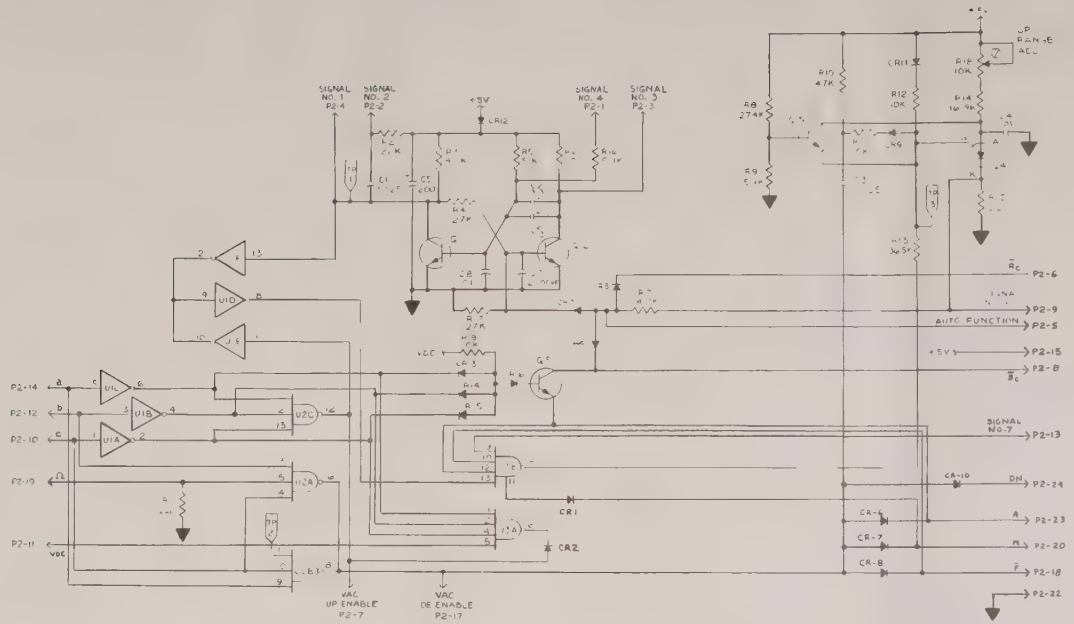
WIRING DIAGRAM
Drawing No. 8425A-1000



NOTES:

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARAD UNLESS OTHERWISE SPECIFIED.
2. DENOTES CHASSIS GROUND.
3. DENOTES LOGIC COMMON.
4. DENOTES INTERNAL ADJUSTMENT.
5. R11 MAY BE OMITTED DURING ADJUSTMENT OF +15V SUPPLY.

A1 POWER SUPPLY
Drawing No. 8425A-1001
101

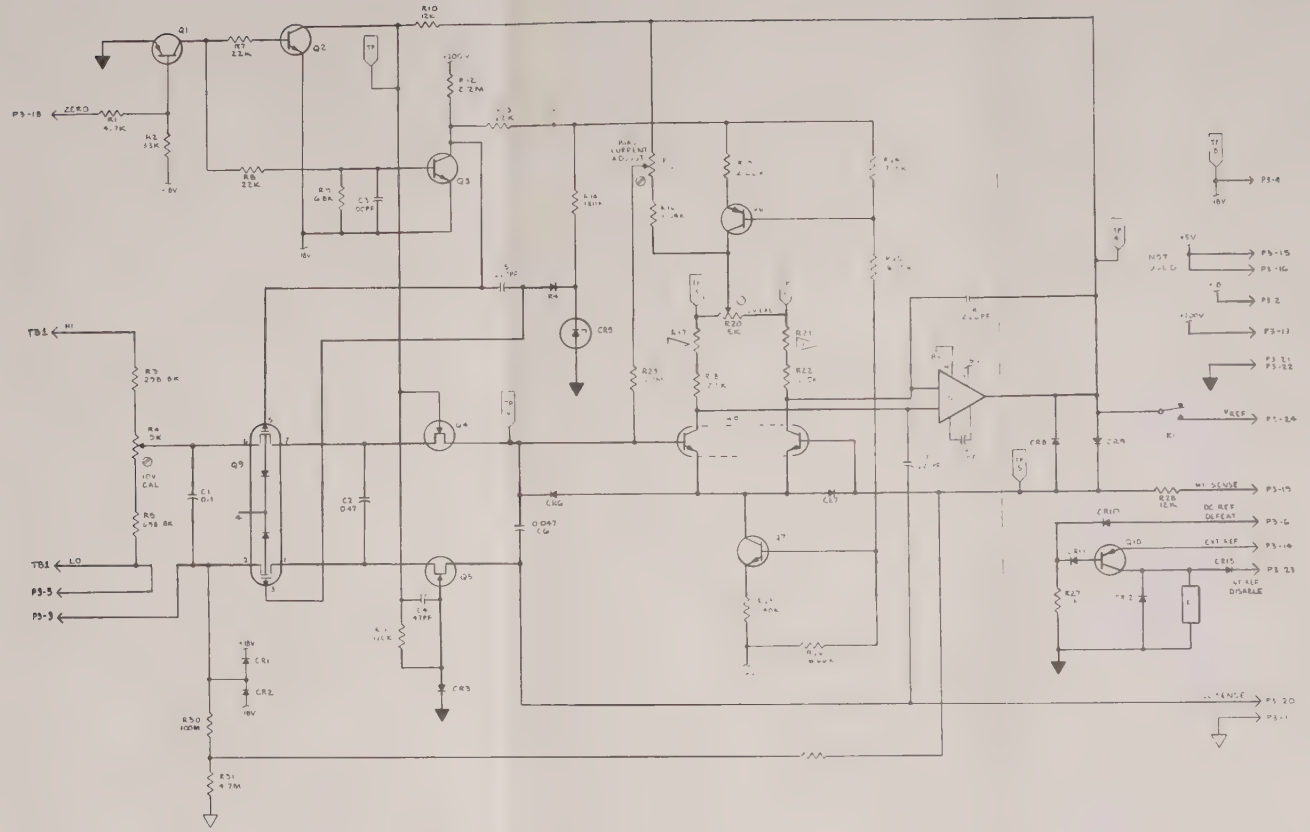


NOTES:

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. ▼ DENOTES LOGIC COMMON
3. ⊘ DENOTES INTERNAL ADJUSTMENT

IC	PIN NUMBERS	
	+5V	COMMON
U1	4	7
U2	14	7
U3	14	7

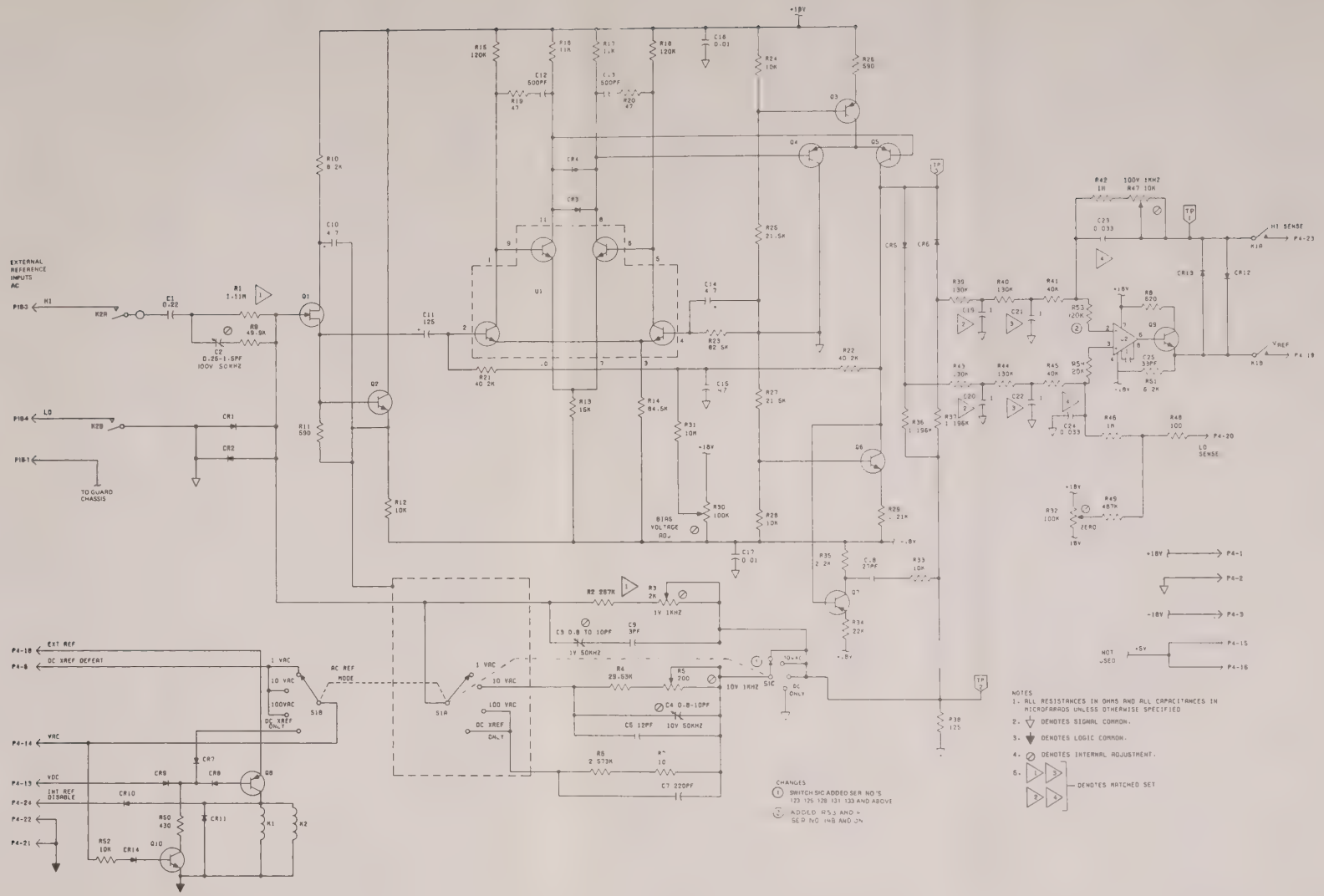
A2 RANGE DELAY
Drawing No. 8425A-1006



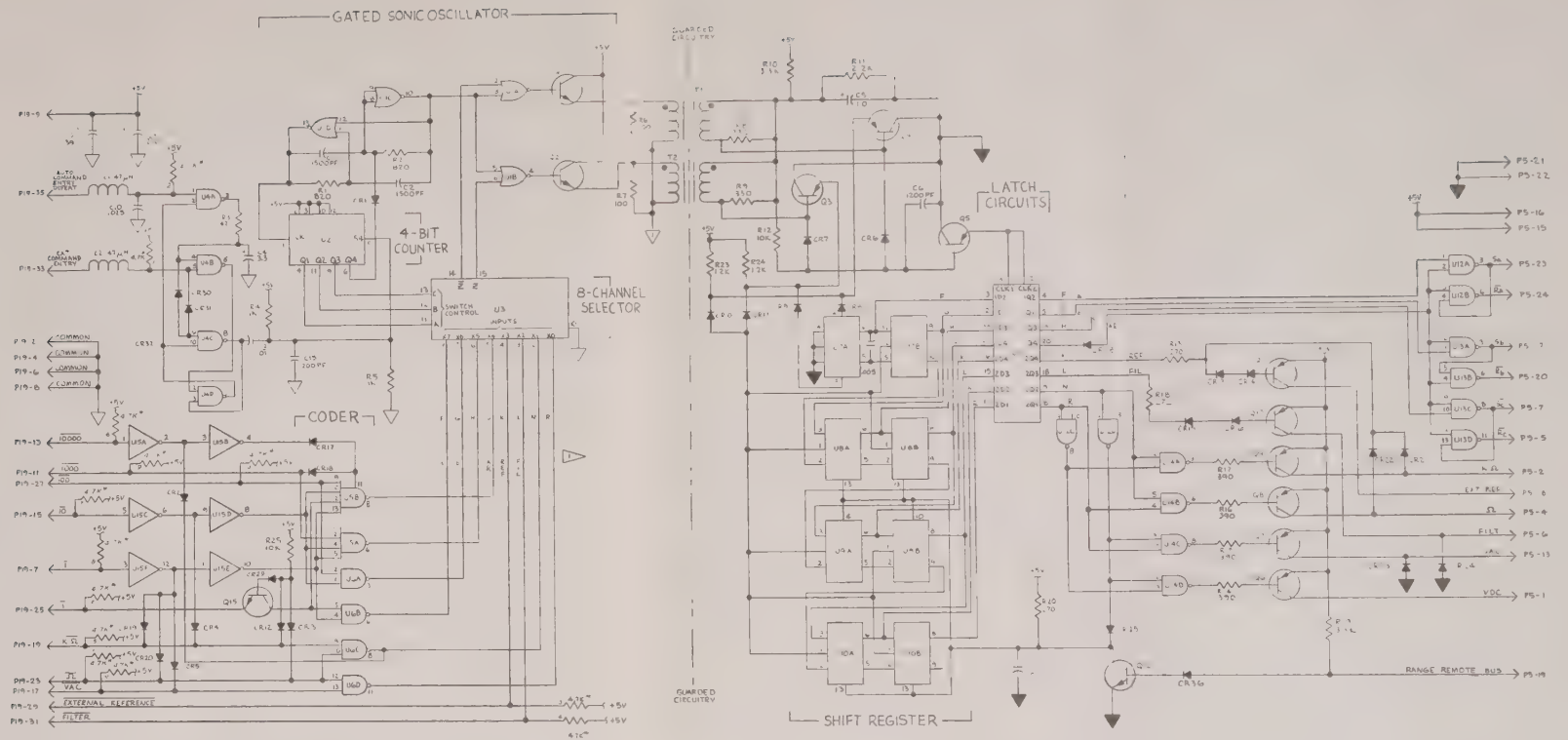
NOTES:

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED
2. ▽ DENOTES SIGNAL COMMON
3. ▼ DENOTES LOGIC COMMON
4. ⊘ DENOTES INTERNAL ADJUSTMENT
5. ▷ DENOTES FACTORY SELECTED PART

A3 EXTERNAL REFERENCE
Drawing No. 8425A-1009



A4 AC EXTERNAL REFERENCE
Drawing No. 8425A-1008



NOTES:

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED
2. ▼ DENOTES LOGIC COMMON
3. ▽ DENOTES COMMON OUTSIDE GUARD
4. ▷ SIGNALS a, b, c, AR, REF, AND FIL CORRESPOND IN FUNCTION TO THOSE IN BASIC DVM BUT ARE NOT IDENTICAL SIGNALS
5. * INDICATES ELEMENT OF RESISTOR NETWORK (RN 1) PIN 16 OF RN 1 TO +5V. SEE DETAIL A.

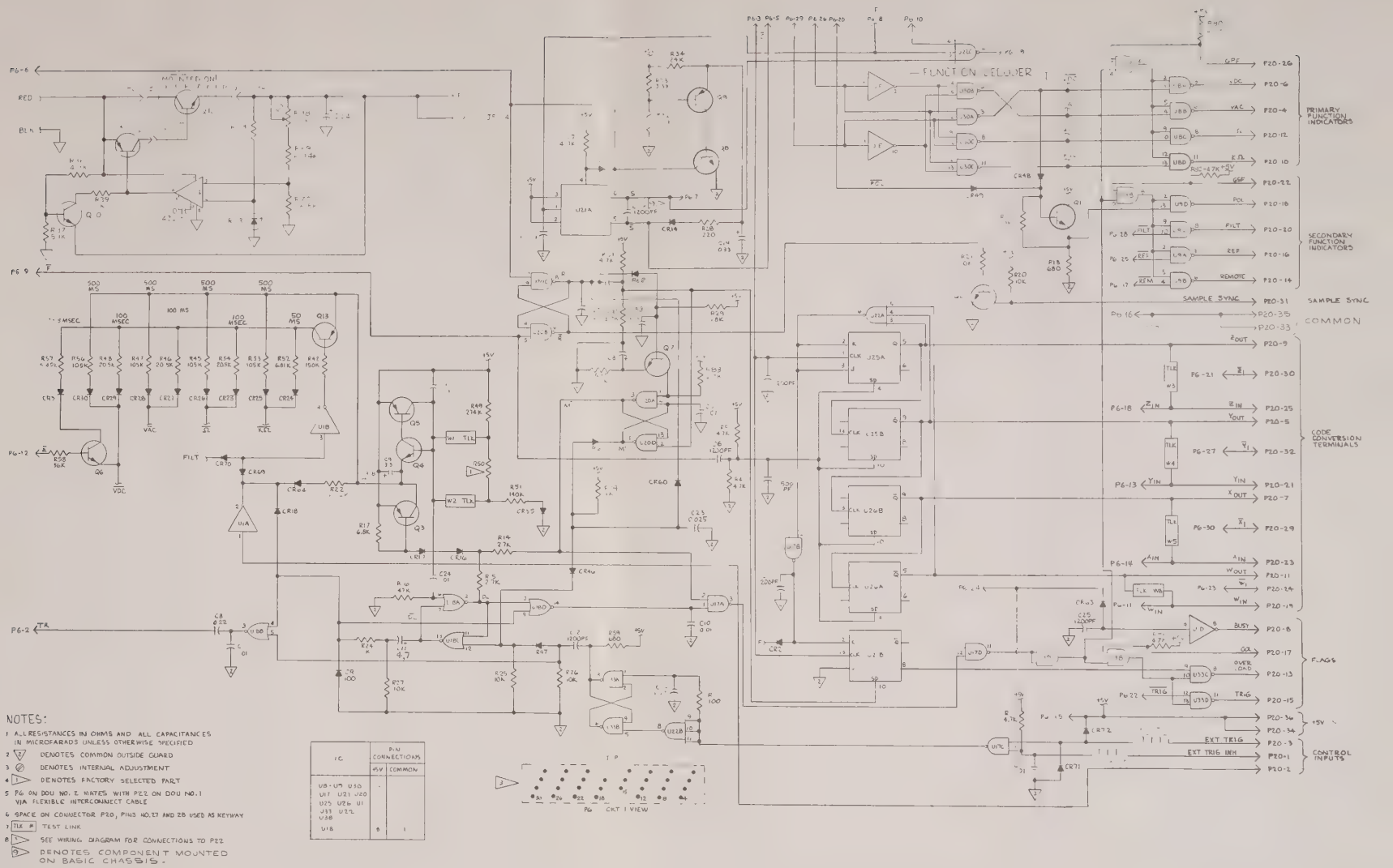
	PIN CONNECTIONS	
	+5V	COMMON
U1, U2, U3, U4, U5, U6, U7, U8	4	13
	16	8

HIGHEST REF DES	REF DES NOT USED
U12	26, 27, 32-35
R19	21, 22
C10	3, 14

RN1

DETAIL A
(SEE NOTE 5)

A5 REMOTE CONTROL UNIT
Drawing No. 8425A-1011



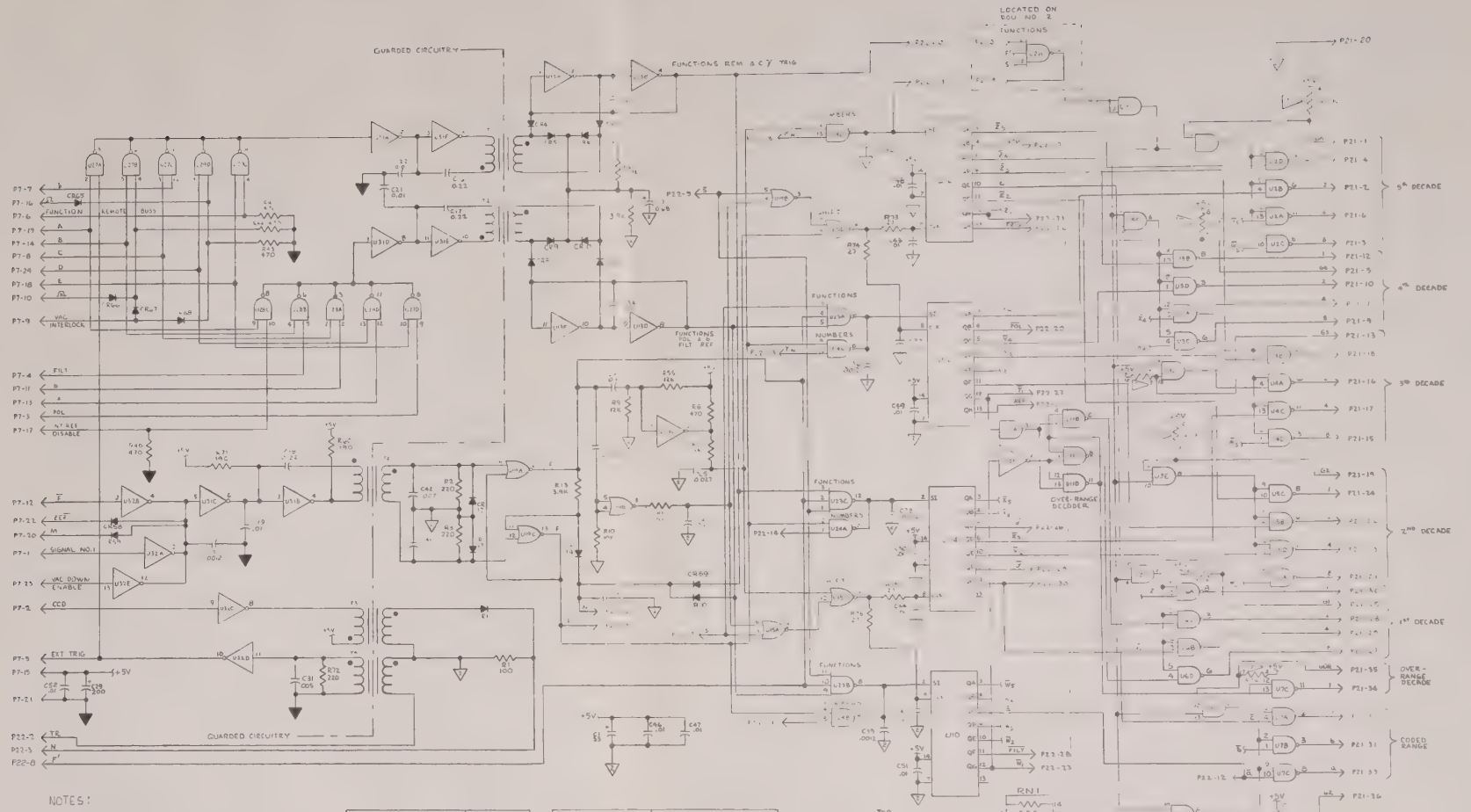
NOTES:

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED
2. ▽ DENOTES COMMON OUTSIDE GUARD
3. ⊘ DENOTES INTERNAL ADJUSTMENT
4. ▷ DENOTES FACTORY SELECTED PART
5. P6 ON DOU NO. 2 MATES WITH P22 ON DOU NO. 1 VIA FLEXIBLE INTERCONNECT CABLE
6. SPACE ON CONNECTOR P20, PINS NO. 37 AND 28 USED AS KEYWAY
7. TLK # TEST LINK
8. ▷ SEE WIRING DIAGRAM FOR CONNECTIONS TO P22
9. ▷ DENOTES COMPONENT MOUNTED ON BASIC CHASSIS.

IC	PIN CONNECTIONS	
	+5V	COMMON
U8-U9 U10 U17 U21 U20 U25 U26 U1 U33 U32 U30		
U18	8	1

P6 CRT I VIEW

A6 DATA OUTPUT UNIT NO. 2
Drawing No. 8425A-1013



NOTES:

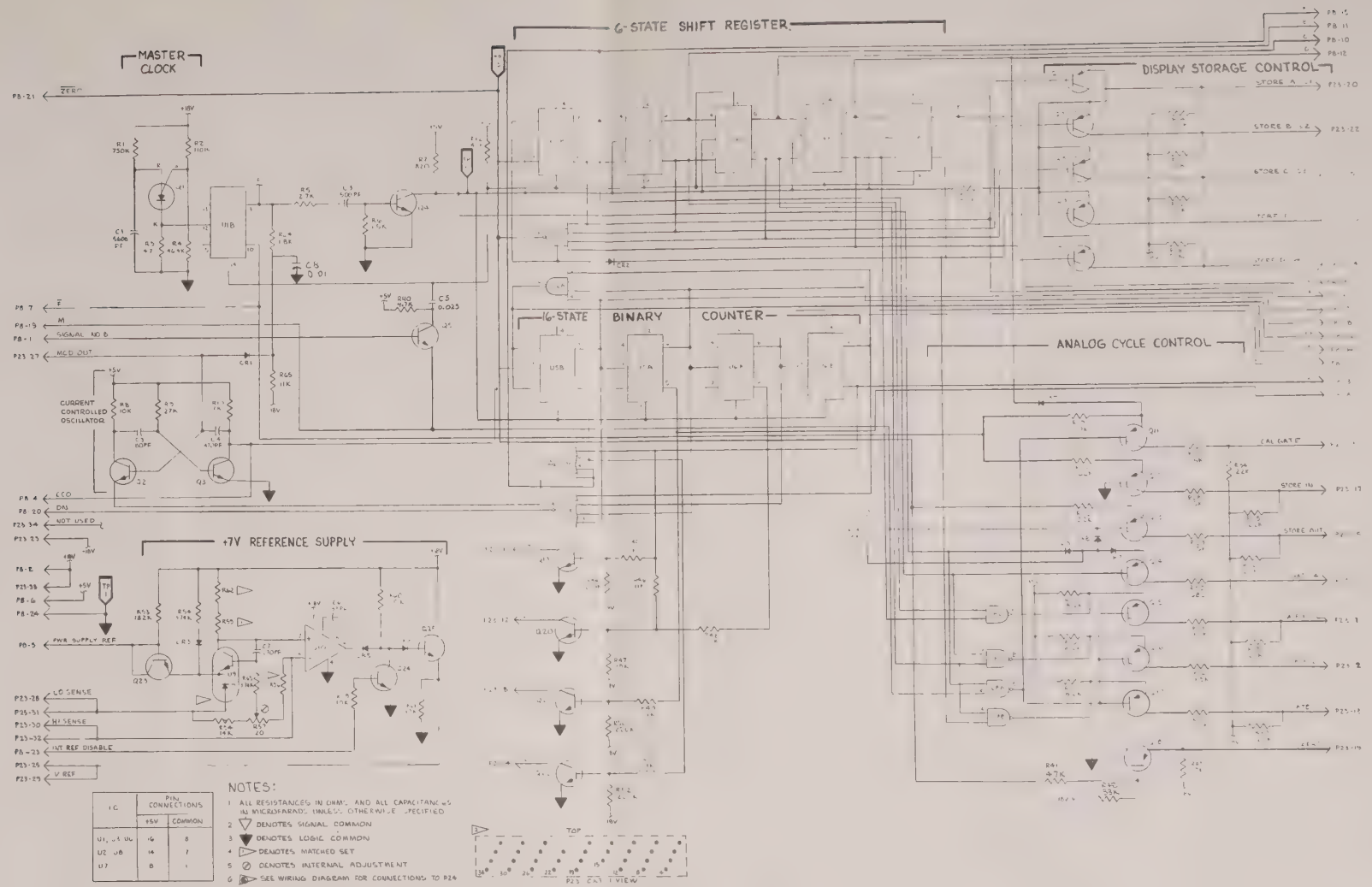
1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED
2. ▼ DENOTES LOGIC COMMON
3. ⊘ DENOTES INTERNAL ADJUSTMENT
4. ▽ DENOTES COMMON OUTSIDE GUARD
5. P22 ON DOU NO. 1 MATES WITH P2 ON DOU NO 2 VIA FLEXIBLE INTERCONNECT CABLE
6. ▷ SEE WIRING DIAGRAM FOR CONNECTIONS TO P6

▷ DENOTES RESISTOR NETWORK (RN); SEE DETAIL A FOR INTERNAL CIRCUIT.

IC		PIN CONFIGURATIONS	
		+5V	COMMON
U3, U7, U11, U24, U27-U29, U10, U12, U14, U16, U13, U31 U23, U33, U32, U36		14	7
U15 U19		8	1

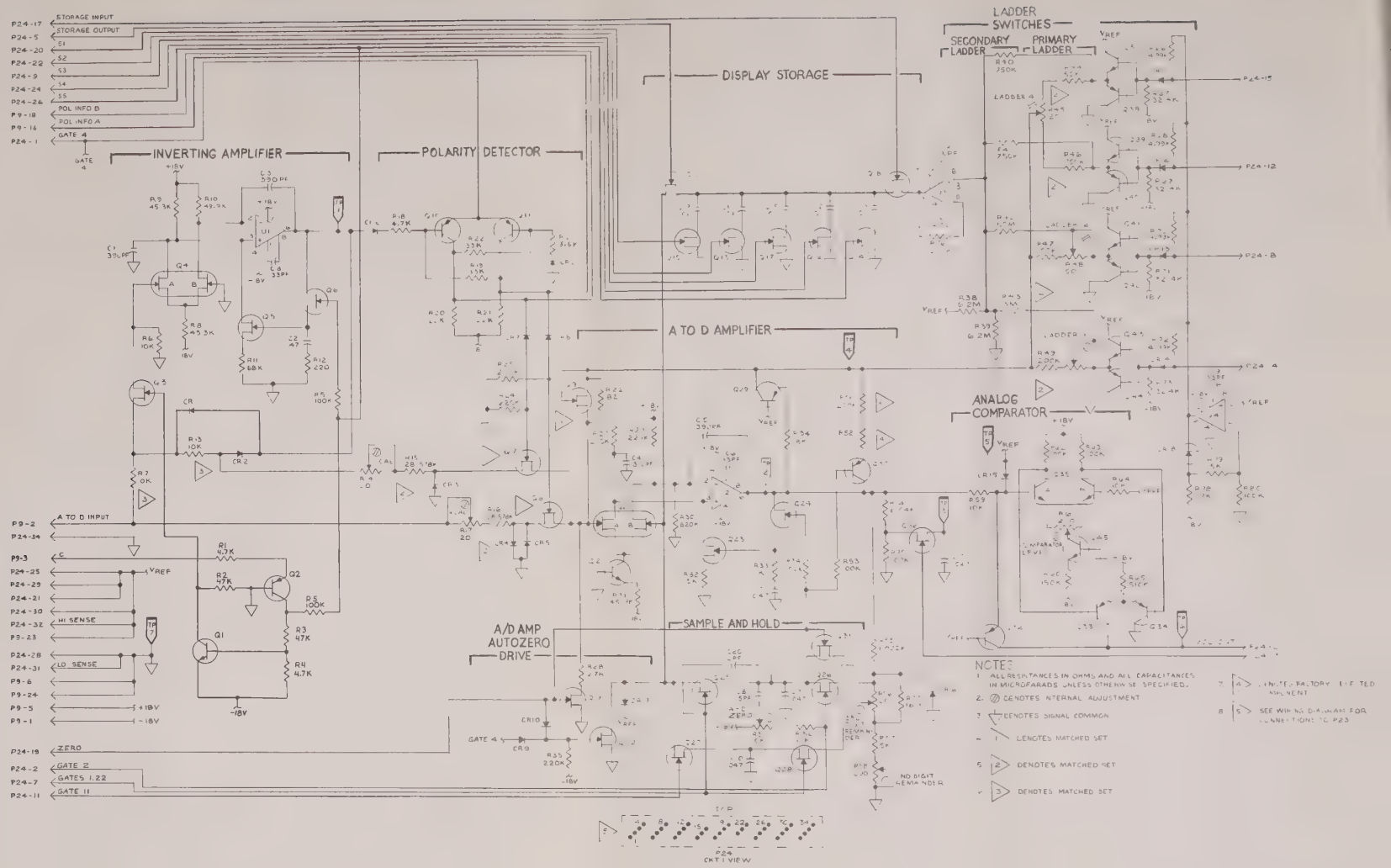
LAST USED REF DES	REF DES NOT USED
C55	4,8-15,20,23,28,45,53,54
R70	2,5,19-33,35-57,60-64
R76	4,5,10,14-19,31-39,42,45-54, 56-59,61-70
U36	1,8,9,11,18,20,21,22,25,26,30 33,34
T1	
RN1	

A7 DATA OUTPUT UNIT NO. 1
Drawing No. 8425A-1012
107

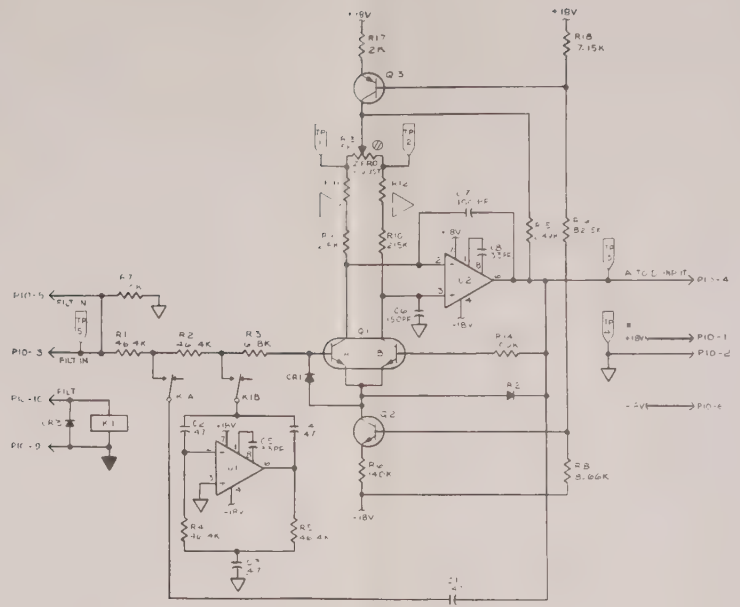


I.C.	PIN CONNECTIONS	
	+5V	COMMON
U1, U4, U6	16	8
U2, U8	14	7
U7	8	1

A8 LOGIC
Drawing No. 8425A-1004



A9 A-to-D CONVERTER
Drawing No. 8425A-1003

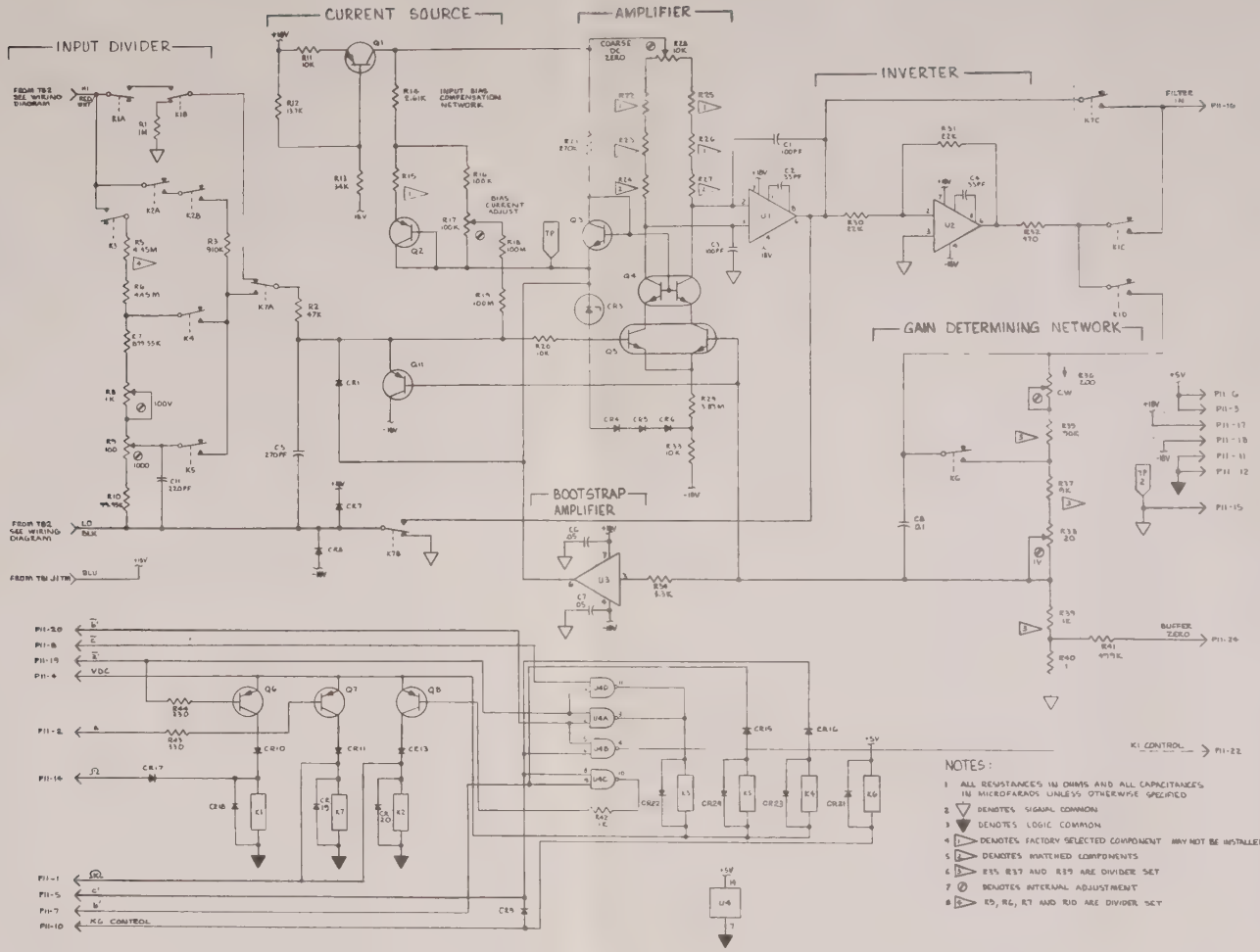


NOTES

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. [illegible] MIN.
3. [illegible] LOGIC COMMON
4. FACTORY SELECTED
5. ∅ DENOTES INTERNAL ADJUSTMENT

A10 ACTIVE FILTER
Drawing No. 8425A-1015

110

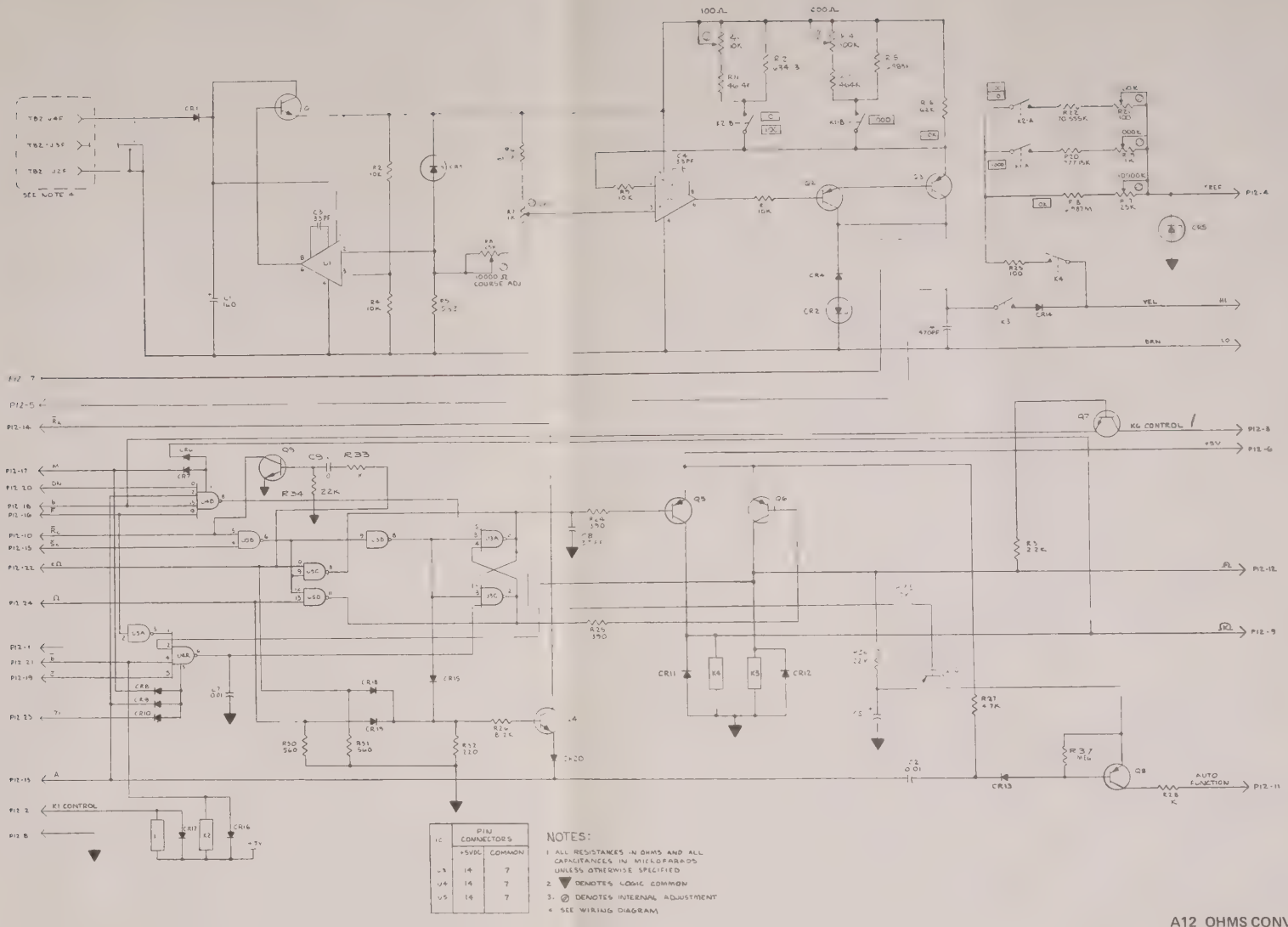


BUFFER RELAY LOGIC

	VOLTAGE RANGE				
	LO		HI		
RELAY	0.1	1.0	10	100	1000
K1	•	•			
K2			•		
K3				•	•
K4				•	
K5					•
K6		•			
K7			•	•	•

• INDICATES RELAY ENERGIZED

A11 BUFFER
Drawing No. 8425A-1005
///

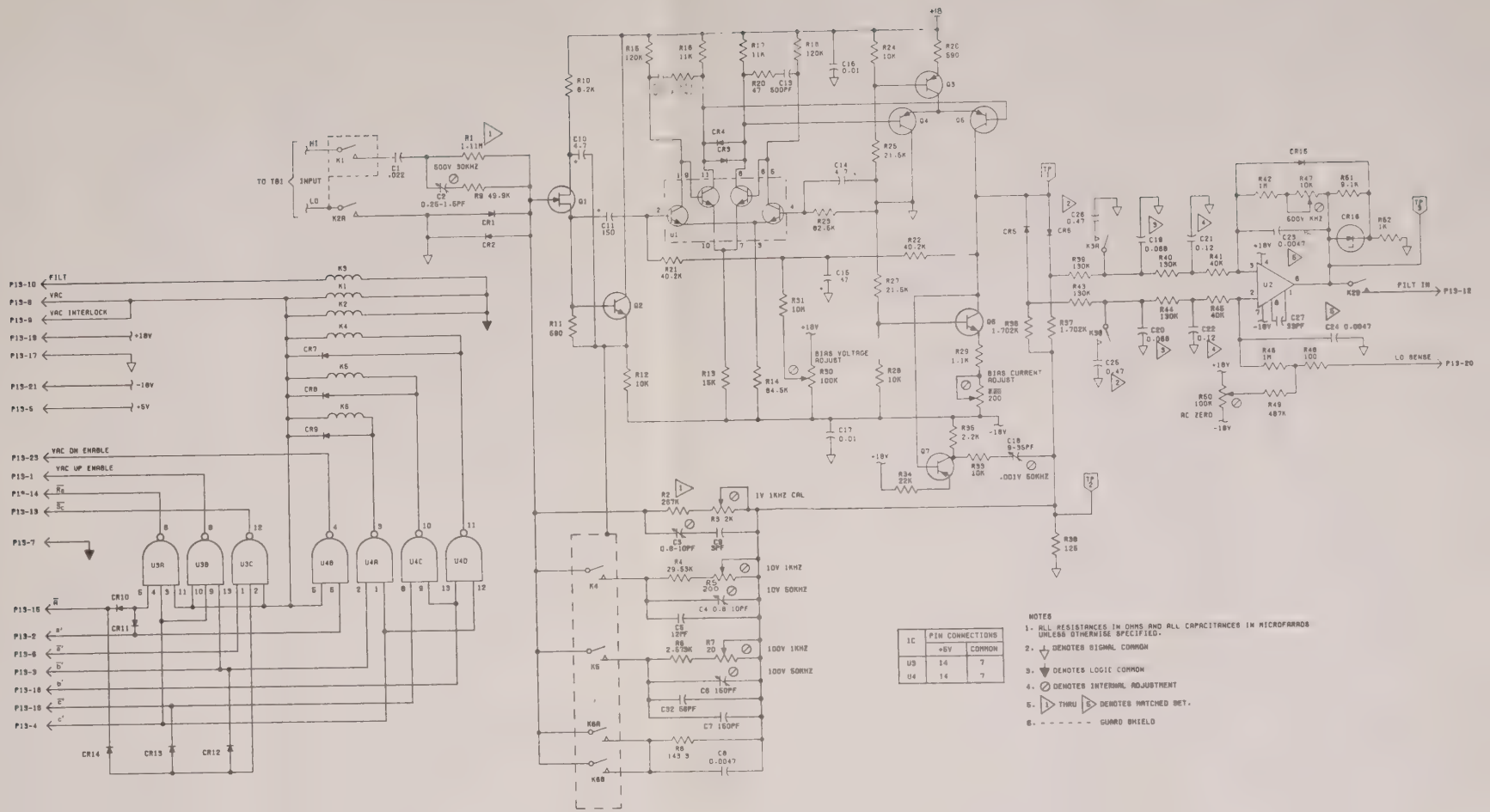


IC	PIN CONNECTORS	
	+5VDC	COMMON
U3	14	7
U4	14	7
U5	14	7

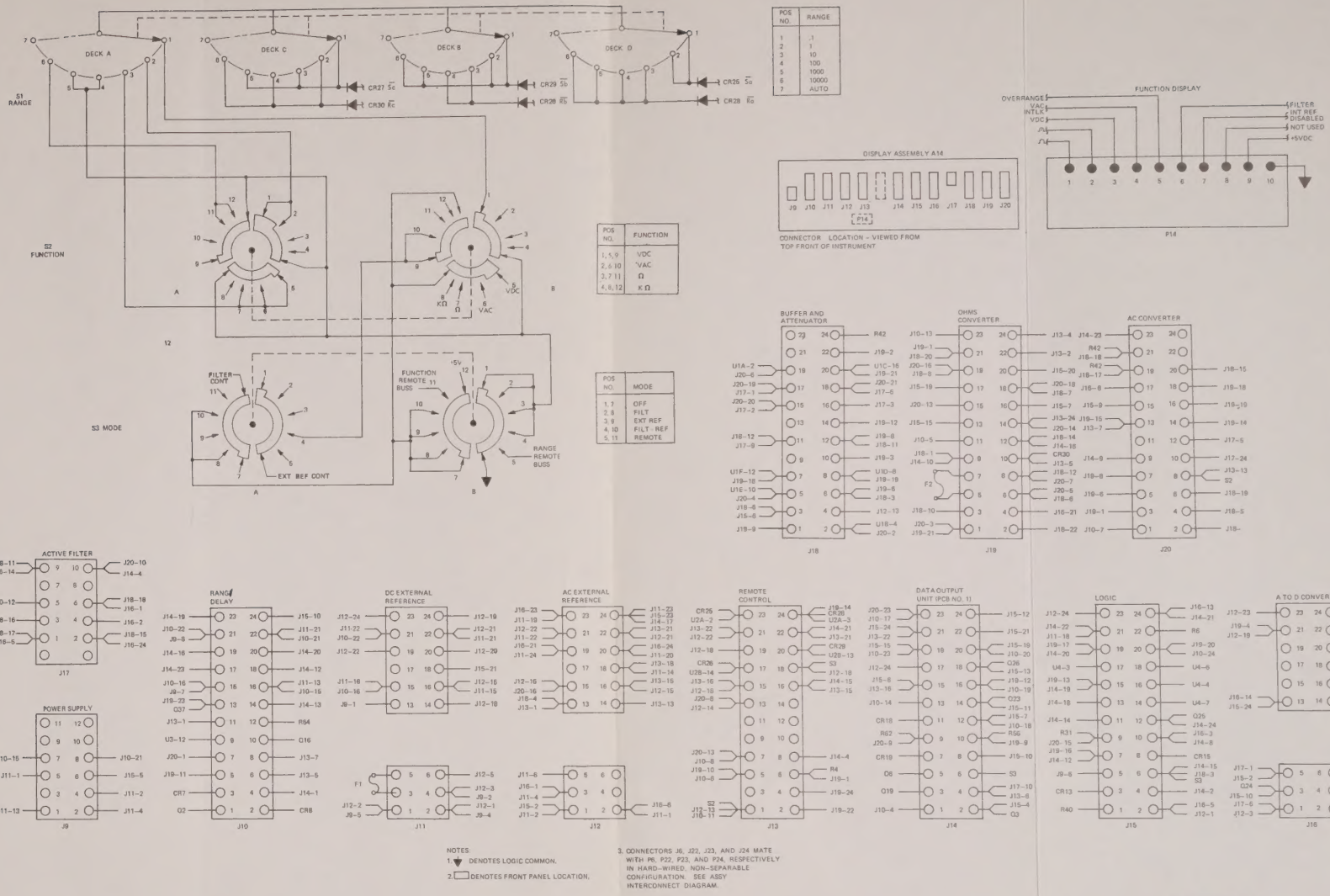
NOTES:

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED
2. ▼ DENOTES LOGIC COMMON
3. ⊘ DENOTES INTERNAL ADJUSTMENT
4. SEE WIRING DIAGRAM

A12 OHMS CONVERTER
Drawing No. 8425A-1010

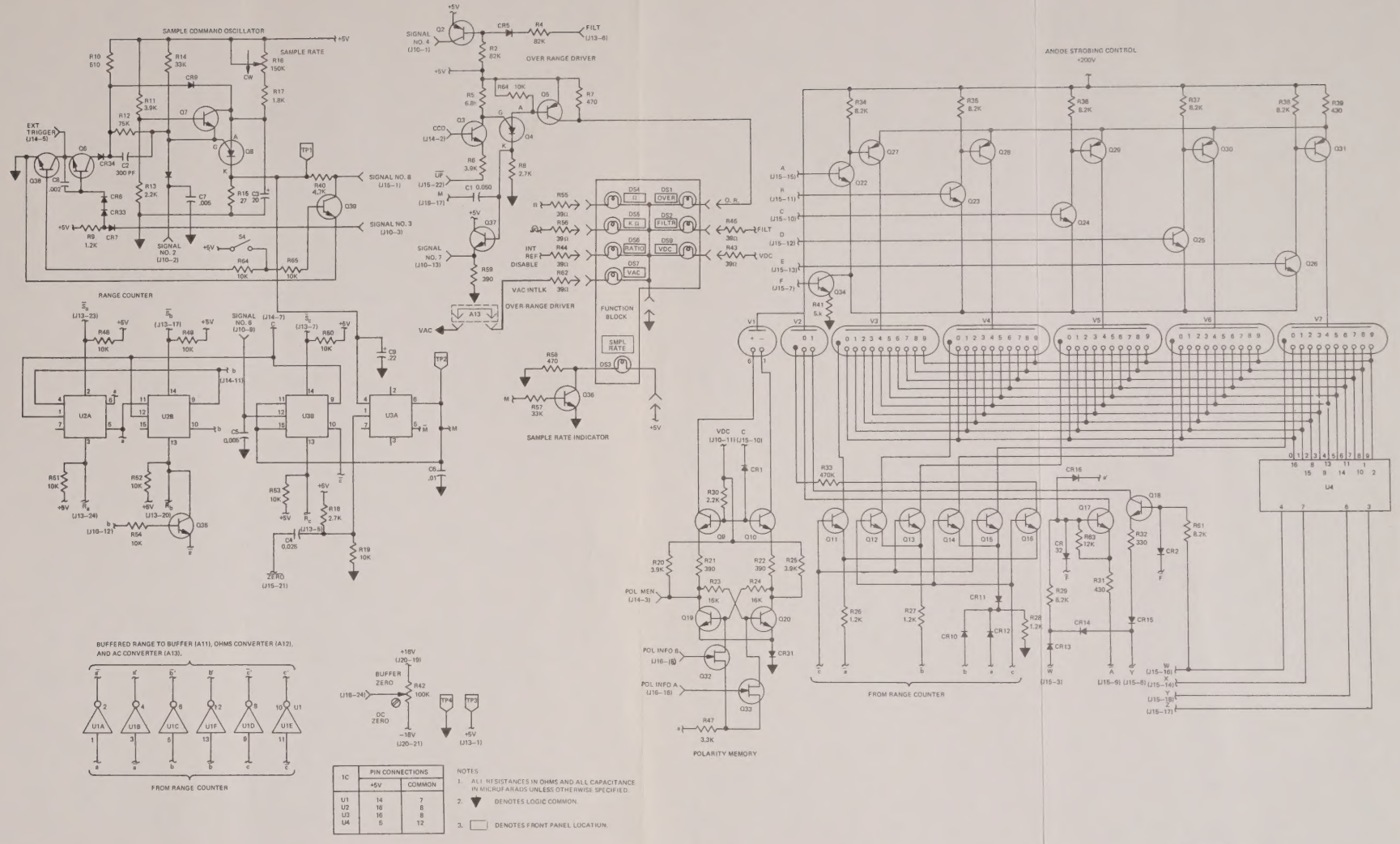


A13 AC CONVERTER
Drawing No. 8425A-1007



NOTES:
1. ▼ DENOTES LOGIC COMMON.
2. □ DENOTES FRONT PANEL LOCATION.
3. CONNECTORS J6, J22, J23, AND J24 MATE WITH P6, P22, P23, AND P24, RESPECTIVELY IN HARD-WIRED, NON-SEPARABLE CONFIGURATION. SEE ASSY INTERCONNECT DIAGRAM.

A14 DISPLAY
Drawing No. 8425A-1002 Sht. 1



IC	PIN CONNECTIONS	
	+5V	COMMON
U1	14	7
U2	16	8
U3	16	8
U4	5	12

NOTES

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. ▼ DENOTES LOGIC COMMON.
3. ▭ DENOTES FRONT PANEL LOCATION.

A14 DISPLAY
Drawing No. 8425A-1002 Sht. 2